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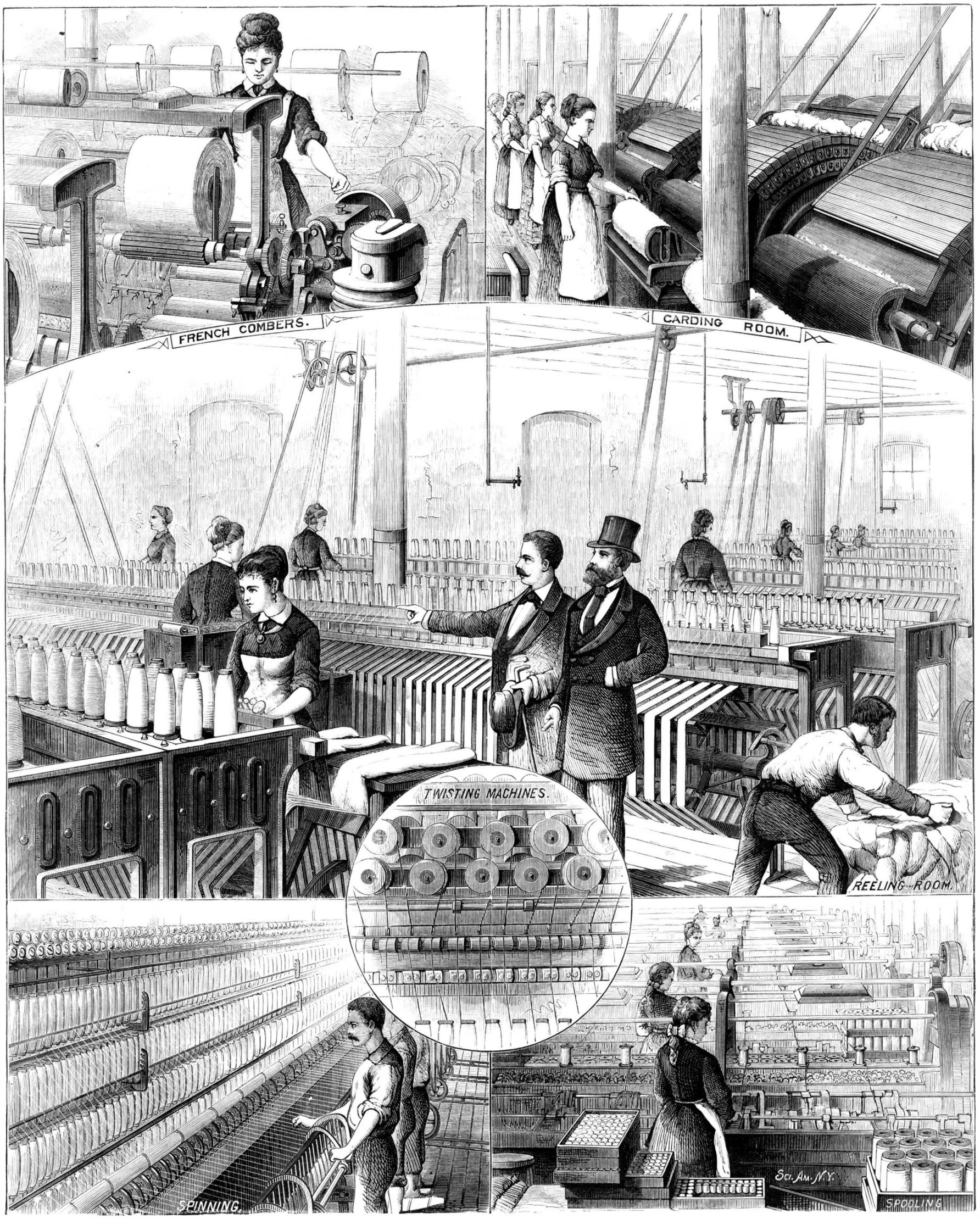

CLARK'S SPOOL THREAD FACTORY.—(See page 289.)

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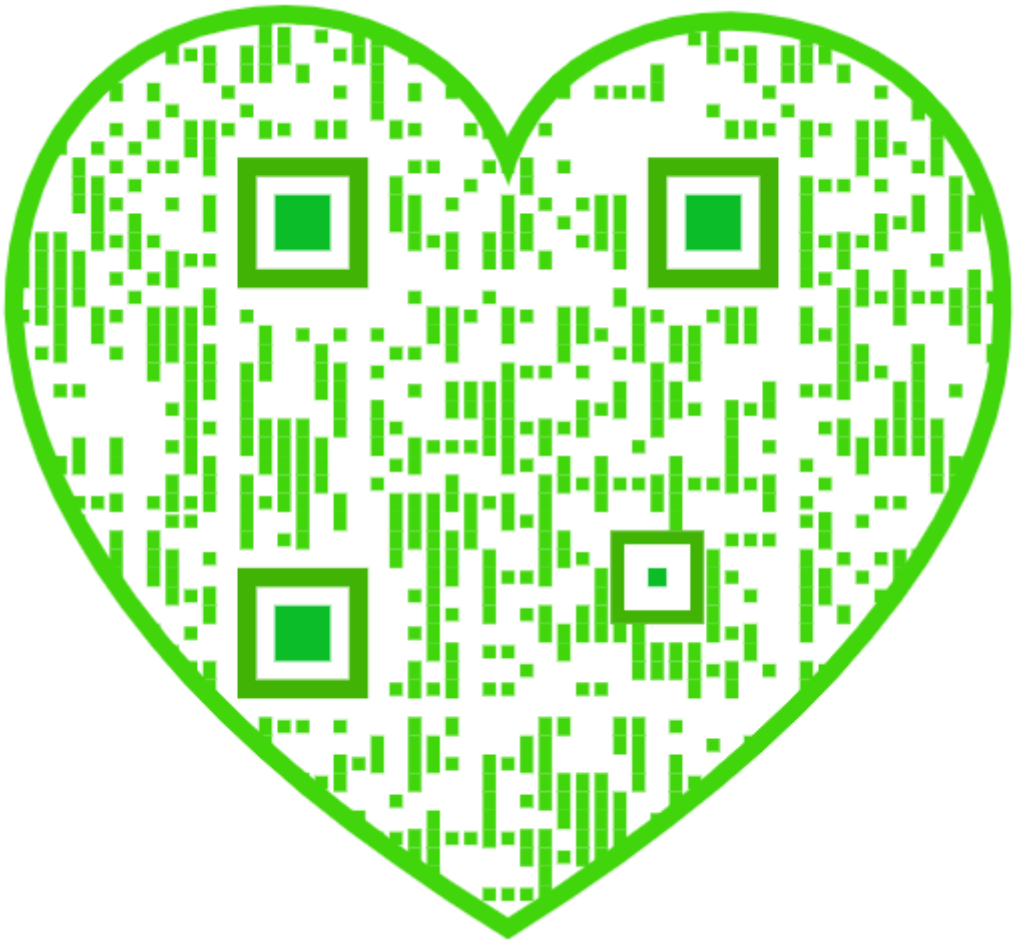

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Contents.

(Illustrated articles are marked with an asterisk.)

American industries*..... 287
Astronomical phenomenon 294
Boring insects, barrel..... ... 296
Cabinet, elegant*..... 297
Catalpa, the, as a timber tree.... 297
Cleveland lighted by electricity. 289
Clifford, William Kingdon..... 295
Conflagration, a great 289
Distance of the sun from earth.. 291
Eels, male, discovery of..... 293
Electric light, Brush 286
Emery wheel stand, improved*.. 294
Exhibition, industrial, Antwerp. 293
Exhibition, international 298
Explosion of the Thunderer..... 293
Feathers in textiles 287
Freighting, cheap 292
Garden, window* 295
Geological survey of Kentucky. 293
Grid, hydraulic, new*..... 231
Hair, human, odor of 298
Hays, Isaac, Dr..... 291
Heat without fuel 293
Ice caves, formation of*..... 296
Industries, American*.... 287
Inventors, a chance for..... 289
Inventions, engineering..... ... 293
Inventions, miscellaneous 290
Lighting, artificial for photo.... 296
Locomotive, a new*..... 294
Machinery, therapeutic* 290
Mangle, improved*..... 294
Marine silk 297
Mildew, black, of walls 293
Milk cooler* 292
Notes and queries..... 299
Orange tree, large..... 297
Organs and pianos, Beatty's 289
Oysters..... 296
Pain and the weather..... 292
Paint, metallic, new 296
Patent right nuisance, the 288
Patents, American, recent..... 298
Pilocarpine, singular action of... 292
Rails, English vs. American..... 289
Reflector for candles*..... 291
Spectacles, improvement in*. ... 293
Study to have ideas..... 288
Telegraph, mirror..... 294
Thread, spool, manufacture of*.. 287
Vanilla beans, cultivation of 298
Water fowl, strange freak of.... 298
Wheat farm, Dakota..... 294
Whooping cough, remedy for.... 298
World's age, new estimate of.... 288
Yak, the*..... 295
Zoological gardens, postal 295

TABLE OF CONTENTS OF

THE SCIENTIFIC AMERICAN SUPPLEMENT

No. 175,

For the Week ending May 10, 1879.

Price 10 cents. For sale by all newsdealers.

I. ENGINEERING AND MECHANICS.—Berdan's Range Finder. A description of General Berdan's apparatus for the speedy measurement of distances, in military and naval operations, by means of telescopes. 4 figures.

Life Saving Experiments. Recent tests of E. S. Hunt's projectile for carrying life lines to wrecks, made at Shoeburyness by the British War Office authorities.

A New Kind of Telegraph Cable. A leaden conductor insulated and inclosed in a lead tube.

Improved Hydro-Extractors Combined with Engines. 4 figures. Description of Messrs. Pierron & Dehaitre's exhibits at the Paris Exhibition.

II. TECHNOLOGY.—Krupp's Latest Patent for Dephosphorating Pig Iron.

The Treatment of Iron to Prevent Corrosion. Discussion on Prof. Barff's lecture. (Continued from SUPPLEMENT No. 174.) Views of Sir Antonio Brady, Dr. Russell, Profs. Graham and Poor, Admiral Selwyn, and Col. Prendergast, with reply by Prof. BARFF.

The Silk Worm and Silk Production. Continuation of Prof. Riley's Instructions (SUPPLEMENT No. 174). 4 figures. Preparation for spring. Gathering cocoons. Choking the chrysalis. Egg laying. Reproduction. Reeling. Food plants. Osage orange.

Bennett's Gelatine Emulsion Process. W. Wainwright, Jr. Superiority of gelatine.

Photography in Colors. Germeuil Bonnaud's process. By M. K. VERSNAEYEN.

Removing Iron and Wire from Wheat by Magnets. 8 figures. Method applied at Humboldt Mill, Minneapolis.

Improved Chrome Black on Wool. Suggestions made by Dr. M. Reimann in a recent lecture before the German Chemical Society.

Oak Stair Case and Screen. 1 illustration. A specially handsome carved staircase lately finished in London.

III. ELECTRICITY, LIGHT, HEAT, ETC.—The Minute Measurements of Modern Science. By ALFRED M. MAYER. How the lengths of light waves are measured. The phenomena of diffraction and interference of light. 9 figures.

Speed of Electric Signals.

IV. CHEMISTRY.—The Chemistry of Plants. Germination the sources of plant food, etc.

Manufacture of Phosphorus

Gas as Fuel

Chemical Items. Electro-chemical actions under pressure. By A. BOUVET.—Gas Regulator for Air Baths. By L. CRESTI.

Galileo and the Inquisition. Historic facts with regard to the condemnation of Galileo by the Holy Office.

V. NATURAL HISTORY, ETC.—Professor Huxley on the Lowest Forms of Life. Full report of Professor Huxley's recent lecture before the Literary and Philosophical Society of Lincoln, Eng. Moulds, protoplasms, diatoms, bacteria, cause of epidemics.

Native Bitumens and the Pitch Lake of Trinidad. Continued from SUPPLEMENT, No. 174.

A Recent Visit to Vesuvius. A graphic report of personal experience by an American traveler.

Glazed Frost. A description of the freezing rain which caused so much damage in France, January 23-25—The conditions determining glazed frost.

VI. ASTRONOMY.—Another World Inhabited like Ours. Description of the Planet Mars; with map. Discovery of the satellites of Mars. Speculations as to the physical conditions of the surface of Mars. The color of its water and soil. Is Mars a world of scarlet grass and ruddy forests?

The Tails of Comets. Professor Bredikhine's notion of three distinct classes of comets' tails.

Constitution of Nebulæ. Ritter's law.

VII. MEDICINE AND HYGIENE.—A new Method of Treatment of Fistula in Ano. Speedy cure.

Ringworm, its transmission by domestic animals, etc. From paper by DR. JNO. V. SHOEMAKER, before American Medical Association.

Elliphantiasis and Filaria. Views of Sir JOSEPH TAYLOR and others. —The Mosquito as an Intermediary Host and Transmitter of Filaria. Its possible connection with elephantiasm.

STUDY TO HAVE IDEAS.

A suggestive story is told of the late Joseph Harrison, of Philadelphia, inventor of the sectional boiler for which the Academy of Arts and Sciences awarded him the Rumford medal, and widely known as the partner of Winans in Russian railway contracts. He was climbing the Gemmi, in Switzerland, accompanied by a young man, and the conversation fell on the younger's chances of rising in the world should he embrace the profession of mechanical engineer. Mr. Harrison favored the idea, saying that this was the age of invention and improvement, that machinery was constantly being applied to new uses, and that he who would make it a study and master it in all its forms would never lack for remunerative employment. "But I have no skill in drawing," objected the young man. "Neither have I," said Mr. Harrison, "I never had time to learn. But I have always found that if I had an idea I could express it on a shingle with a piece of chalk, and let a draughtsman work it out handsomely and according to rule. And I've generally had ideas enough to keep three or four draughtsmen busy. You can always hire draughtsmen, but you can't hire ideas. Study to have ideas, my boy." It may be added that Mr. Harrison's success was due not to scholastic advantages, but to native capacity and personal effort.

It is a significant circumstance, and one that furnishes the basis for the severest criticism of the current methods of academic instruction, that men who, like Mr. Harrison, have attained signal eminence for originality of thought have rarely been men of much schooling.

The grand aim of the schools is to furnish the student with knowledge, a great deal of knowledge in a little time. To do this the method of cram, not that of original research and critical investigation, has to be adopted. The student's mental habit becomes that of a receiver, not that of a discoverer. He is loaded with knowledge, but in taking on the load he loses, through lack of use, if not through stern repression, the capacity to think or act except along the lines of conventionality and habit. The scholastic bias becomes stronger than the original bent, and the man loses in productive power in proportion as he gains in learning.

The fault does not lie wholly in the schools. The people demand for their children a teaching that can be measured quarterly—measured by quantity, not by quality; and on this score the child who takes most kindly to second-hand ideas is sure to win. Capacity for original ideas, for original and personal independent work, is at a discount. In other words, what the man most needs to have, the child or youth is least encouraged in cultivating.

While knowledge and skill are both highly desirable, they are still of second rank, and it is possible to acquire them at too great a cost. If a man has ideas—original, individual, creative ideas—he can usually hire skill and buy knowledge; he cannot hire ideas. We should be the last to decry skill or knowledge. They are essential elements of education. But they should be gained by processes which make them the tools, not the end of culture. The man should be the master, not the slave of his learning; and whether he is the one or the other depends very largely on the way his knowledge has been gained. And it is better to be the master of a little knowledge, with capacity to use it creatively, than to be the unproductive carrier of all the learning in all the libraries. Our young readers whose scholastic advantages, so-called, have been few, may well take the lesson to heart. Study to have ideas; life will give no end of opportunities for using them.

"THE PATENT RIGHT NUISANCE."

Under this heading the New York *Herald* ranges itself editorially with the opponents of inventors' rights, and discusses the alleged defects of the American patent system with the zeal of a recent convert and the ingenious perversion of the facts of the case characteristic of a misinstructed or unscrupulous advocate. The article reads very like a feeler thrown out by the clever attorneys who so persistently lobbied for certain anti-patent associations before the last Congress. It runs in this wise:

"Americans are notoriously the most inventive race in the world, and the number of patents issued yearly from Washington amounts to many thousands. An inventor like Edison, who has taken out more than 200 patents, is forced to spend no small portion of his time in ascertaining the scope of analogous inventions made by his numerous rivals, and it is alleged that the success of his recent experiments upon the electric light has been seriously impaired by finding that most of his proposed improvements were already protected by letters patent. Many of the more obvious inventions have been independently made by dozens of persons, only to find that they had been anticipated long before by some unknown individual who had never taken the efficient steps to make his invention known. The issuance of a patent thus becomes, in a vast majority of cases, only a means of repressing instead of stimulating independent inventions.

"That this evil has assumed vast proportions and calls urgently for remedy will not be denied by any one who is familiar with recent discussions in the scientific and technical periodicals. It is well known that nine tenths of the patents issued are of no practical utility, and only serve to confuse the inquirer and waste valuable time. Every invention of first-class importance has to be 'protected' by a score of minor patents which have nothing to do with the main discovery.

"It has even become a question of late, in Europe and America, whether the whole patent system ought not to be brushed away as a mere impediment to the development of manufacturing industry, leaving future inventors to rely for their compensation upon such advantages as their exceptional facilities for the production and introduction of their specialities as would naturally follow from their priority in the race and their more perfect possession of all the details. In nine cases out of ten the change would be to general advantage; still, some provision ought to be made for discoveries of far-reaching value.

"Three remedies would seem to be desirable. In the first instance the number of patents issued might be restricted at least ninety-five per cent by refusing all applications for such patents as are obviously of little or no value, as well as those which do not represent any new principle. Secondly, many of those inventions which are really of great practical importance should be at once purchased by the government for the general benefit of the public, every inventor being required to state his terms on making his application. With inventors of real merit the government can well afford to deal generously. Lastly, all patents should be considered to have lapsed when it can be shown that a reasonable period has elapsed without any effort on the part of the inventors to introduce them."

The assurance with which the name of Mr. Edison is made a peg on which to hang a sweeping indictment of the patent system is positively amazing. Just think of Mr. Edison as a victim to patent rights! and of the community at large as being deprived of the blessings of electric lighting because other men had been at work upon the problem before Mr. Edison took it up!

If Mr. Edison's word is good for anything, the public has the best of reasons for believing that, so far from having been hampered by the patent system, he has, as an inventor, been largely a product of it. Without the protection it has given him he would never have been an inventor; certainly he would never have devoted his life to that laborious and expensive pursuit. He has made invention his business because there is money in it to him, though infinitely greater profit to the world at large. His inventions are paying property, because, and only because, they are protected as property by all civilized nations.

The second assertion is equally at variance with truth. Grant, for argument's sake, the absurdly untruthful statement that nine tenths of the patents issued are of no practical utility. Does it follow that "they only serve to confuse the inquirer and waste valuable time?" The very opposite is true. A liberal patent system insures the publication of all efforts in new directions, and that is a matter of infinite importance. In his exploration of the unknown every inventor strikes many blind or doubtful paths. Shall he, or shall he not pursue them? Time is limited and he has far to go. The records of the Patent Office ought to furnish him the results of all previous explorations. Every patent issued is, in this way, a means of saving fruitless effort and waste of time. Even "worthless" patents thus become valuable, as warning signboards to the explorer. In the records of the Patent Office he reads: "A tried this way and found it unprofitable;" "B tried this—'no thoroughfare;'" "this road leads to the property of C;" "this to where D was lost in fruitless exploration;" and he guides his efforts accordingly.

The great object of the patent law is to secure the early publication of all these mental itineraries; and every measure calculated to prevent their publication is mischievous. Not unfrequently, also, the "worthless" patent fails for lack of some means for overcoming a special difficulty, which means are supplied by a discovery made after the life of the patent has expired. It stands, however, a permanent contribution to the history of thought, and the next man is saved the first inventor's fruitless toil; he freely bridges over the difficulty by the aid of the last discovery, and the world gets a valuable invention which it would have missed had the original "worthless" invention vanished unrecorded.

The *Herald's* next statement with regard to the recent tendency of American and European thought, with respect to the policy of issuing patents for inventions, is another flat misstatement of fact. The current of thought, not only among the common people, but among statesmen, is decidedly in the direction opposite to that asserted. Witness the steady progress of foreign patent systems toward the liberality which has made the American system so superior to all others.

The tendency of all civilized nations is steadily toward the fuller and freer recognition of the rights of intellectual property. Countries which, like Switzerland, originally denied the possibility of intellectual property, proclaimed "free trade in ideas," and refused to recognize the inventor's right to the products of his inventive toil, have learned that sound policy as well as abstract justice demands an advance to the position of higher civilization, and are copying the American patent laws so far as they are able to.

The limitations of space forbid an extended notice of the *Herald's* "remedies." They have been presented in every possible aspect, by the agents of anti-patent associations, in the committee room and in Congress, only to demonstrate more clearly their pretentiousness, the impossibility of putting them into practice, and the certain injustice to inventors, small manufacturers, and the public at large, that would flow from an attempt to carry them into execution.

ENGLISH VS. AMERICAN RAILS.

A short time since Mr. Vanderbilt purchased in England, for the New York Central Railroad, 10,000 tons of steel rails. These rails cost, on shipboard, £5 a ton. To this must be added a duty of $28 a ton, making the cost of the rails here

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about $53 a ton. The price of American steel rails is from $45 to $47 a ton; in large lots perhaps as low as $43. It is clear, therefore, that Mr. Vanderbilt paid for the English rails something like 25 per cent more than American rails would have cost him.

Against this bargain certain American gentlemen, professing to speak in the interest of American rail makers, have protested with much vigor. One of these gentlemen, Mr. Alfred Earnshaw, of Philadelphia, after taking Mr. Vanderbilt severely to task for wasting his stockholders' money, closes his letter with these words:

"If a railroad president has any duties toward his stockholders, if a man occupying high public places has any duties toward the well-being of a great national industry, and if the railroads have any duties toward American steel rail makers in return for their services past and present, Mr. Vanderbilt's duty bids him plainly and openly give his reasons for this purchase."

When approached by a *Tribune* reporter, Mr. Vanderbilt pardonably declined to be brought to book after the fashion proposed. A "prominent official of the New York Central Railroad" proved less reticent, and explained the transaction in a way that, if true, reflects little credit upon the manufacturers of steel rails in this country. He said that the order was not given for the English rails until careful tests, chemical and other, had proved the English rails to be worth the price. The English manufacturers gave a guarantee of twelve years' wear, all rails not coming up to the standard to be replaced free of cost. Every American manufacturer applied to declined to furnish such a guarantee, five years being the longest time for which a guarantee was offered. "It is well known to railroad men," said the Central officer, "that the utmost limit of wear for American steel rails, as now manufactured, is five years, where they are subjected to the strain of heavy traffic such as continually passes over the New York Central road. Some of the English rails now laid on this road have been in constant use for many years without showing the least evidence of wear, while American steel, laid at the same time, has worn out, and must be replaced." That (these conditions being true) the English rails were the cheaper and the bargain a good one goes without telling.

There remains, however, a serious question for the American rail makers to answer, namely, Why are American rails inferior to the English? Mr. Earnshaw writes: "In justice to Mr. Vanderbilt, I will say that I believe it to be true that the American rails laid on his Western roads have worn out quicker than the foreign rails, but their life has not been sufficiently short to account for the difference in price."

On the contrary, the difference between a five years' guarantee and one for twelve years does amply justify the payment of a price larger by only 25 per cent. And the case against the American rail makers is even worse than appears on the face of this transaction. The American maker has in his favor a duty which practically doubles the cost of English rails in this country. Why is it, then, that the American manufacturer cannot make for $50 as good a rail as the English can for $25? The English price is no doubt exceptionally low just now; but the duty more than equalizes the conditions.

Since the foregoing was in type, the president of the American Iron and Steel Association, Mr. D. J. Morrell, has replied in the *Tribune* to the statements of the railway official quoted by the reporter of that paper. Mr. Morrell says that the alleged inferiority of American rails is not sustained by fact; and that the asserted brevity of the life of American steel rails "is a bold assertion of what is absolutely and entirely untrue." He says: "That some American steel rails may not under certain conditions last five years or even one year may be true, and it is equally true of foreign rails. The usual guarantee of American rails is five years' wear, with an agreement to replace all such as give out from fair usage within that time; and for this guarantee no extra charge is made. It is not fair for Mr. Vanderbilt to suppose that all American manufacturers of steel rails are so stupid as to make an inferior article, when, with the best of materials to start with, they can with the practice of intelligence and skill make a good rail with just as little cost as they can an inferior rail."

Further on Mr. Morrell says: "The hardness of temper of the rails is regulated by the amount of carbon the steel contains, and this is usually controlled by the roads that use them, some railroad managers requiring their rails much softer than others, preferring toughness and immunity against possible accidents from breaking, to the extreme hardness which would insure greater endurance. American rails have been used for more than ten years on many of our leading roads, and for the last six or eight years more than a million and a half tons have been put down, and I am ignorant of the first instance of any such complaint as would justify the assertion so boldly made by this 'prominent official;' indeed, I know exactly to the contrary."

In every large lot of rails there is a liability to be a few imperfect ones, from flaws in the ingot or from mechanical defects which cannot be detected by the closest and most careful inspection, but these imperfections usually disclose themselves during the first few months' service. This is equally true of English as well as American rails. The number of rails so failing within five years is so inconsiderable that the guarantee has never been considered any great hardship to manufacturers. If the utmost life of American rails is limited to five years, as asserted by a "prominent official," the New York Central might have its road kept constantly supplied with new rails under the usual American guarantee, without any expense to the company beyond the first outlay."

Touching the asserted twelve years' guarantee, Mr. Morrell says:

"I am not aware that Mr. Vanderbilt has ever asked for twelve years' guarantee from American makers, or even asked from them, certainly not from very many of them, at what price or on what terms they would supply his wants. His purchase of these foreign rails would seem to have some other motive than the one given. The 'economy' plan is too thin for credence."

While the indications are that the immediate interests of the Central Railroad may not have been the controlling element in determining this transaction, the makers of American steel rails are still left under the burden of a serious implication. It is not sufficient for them to deny the alleged inferiority of their rails. The charge must be disproved by specific and abundant evidence. The New York Central road is not the only road that has a large traffic, or that has tried American steel rails.

If other roads, under severe tests, have found American rails as durable as the English, their testimony would just now be of great value. If, as Mr. Earnshaw admits, they have not worn so well as English rails, it is the duty of the American makers to explain the cause, if they can, and remove it.

A REMARKABLE CONFLAGRATION—THE RIVER BETWEEN NEW YORK AND BROOKLYN SET ON FIRE.

One of the important receiving stations of the Standard Oil Company in this city is near the foot of Sixty-fifth street, on the bank of the Hudson River. Here the company have tanks for the storage of oil, which is brought directly into their premises in cars that come to the city over the New York Central and Hudson River Railway. From this station the crude oil is in part distributed in barrels to the shipping along the river, and to other points, but a large portion is transferred through a pipe line directly to the refinery at Hunter's Point, in Brooklyn. This pipe line extends under the streets of New York across the city to the East River, and thence under the bed of the river to the Brooklyn shore. The river at the point where the pipe line crosses is about three-quarters of a mile wide, a large and splendid stream, usually covered with sailing and steam vessels engaged in the ordinary services of the commerce of a great city like New York. The entire length of this oil pipe line is three miles, the oil being forced through it from the Hudson River to Brooklyn under a strong pressure, by means of a large Blake steam pump. On Sunday morning, April 20th, at a time when the river happened to be comparatively free from vessels, an appearance something like a water spout was observed on the river near the Brooklyn side. The water rose high up in the air and fell in graceful showers all around. In a very short time the surface of the channel was covered with oil, which naturally spreads rapidly on the surface of water and which was carried down stream also by the ebbing tide. This explained the unusual phenomenon. The oil pipe had burst at the bottom of the river and the oil was flowing in a big stream to the surface. Several little boys who were playing around the dock noticed the oil and promptly threw some lighted matches into the river. The oil ignited, and in a few seconds the whole river front was ablaze, and the dock also caught fire. The boys ran away rather more scared than happy. The fire engines were sent for as quickly as possible. Three responded. The fire on the dock, in rear of which are gas works, was quickly extinguished, and in about a quarter of an hour there was no appearance of fire on the river. But just as the firemen were about to leave, flames shot up here and there along the channel. Now and then, fanned by fitful gusts of wind, they lengthened enormously, and swept the fences and trees along the river front, scorching them here and there.

The oil continued to bubble up from the leak at the bottom of the sea, and the flames in that vicinity rose to a great height. It was not until all the oil in the pipe had risen to the surface and had mostly been consumed that the flames died out. This was fully four hours after the outbreak. The quantity of oil lost must have been very great. Beyond the scorching of a few vessels, the fences, trees, and the partial destruction of the dock, there was no other harm done.

Cleveland to be Lighted by Electricity.

We learn that the authorities of Cleveland, Ohio, have made a contract to light a large portion of the city with the Brush light. The lamp posts, which are very ornamental, and twenty feet high, have all been erected, and it is expected that the lamps will be placed in position in a short time. The results of this generous experiment in electric lighting will be noted with great interest by the public in general and electricians in particular.

PLASTER of Paris mixed with equal parts of powdered pumice stone makes a fine mould for casting fusible metals. The same mixture is useful for incasing articles to be soldered or brazed. Casts of plaster of Paris may be made to imitate fine bronzes by giving them two or three coats of shellac varnish, and when dry applying a coat of mastic varnish and dusting on fine bronze powder when the mastic varnish becomes sticky.

AMERICAN INDUSTRIES.—No. 11.

THE MANUFACTURE OF SPOOL THREAD.

In our last issue we gave an illustrated description of the manufacture of sewing machines; we now present to our readers a description of the manufacture of an article without which, in its perfect form, sewing machines would be useless. Thread, although one of the smaller articles of manufacture, is the foundation of an immense industry, and the processes and machinery by which it is produced have been developed and perfected until it appears that there is little room for further improvement.

The primitive method of spinning cotton thread was to attach a bunch of the carded cotton to a forked stick called a distaff, and, holding it under the left arm, the cotton was drawn out and twisted with the left fore finger and thumb; the size and quality of the thread being regulated solely by the delicacy of the touch as it passed through the fingers. As soon as sufficient length was twisted to reach to the ground, the thread was wound upon a stick called a spindle. In this manner the spinsters of Old England made their thread, and it was not until the time of Henry VIII. that the spinning wheel—which had long been in use in India—was introduced into England. After this came the spinning jenny, then the spinning mule, and then a host of machines for various branches of textile manufacture.

Without doubt the manufacture of thread, as conducted at the establishment of Messrs. Clark, may be taken as an example of the best practice. Entering their extensive manufactory, in Newark, N. J., one can but notice, first of all, the system, order, and cleanliness that everywhere prevail; the gleam of polished machinery, the hum and flutter of the thousands of spindles, spools, and reels, the ceaseless progression of the material from the raw to the finished state, convince us that the world must use an enormous quantity of thread, and, while wondering "where in the world" it all goes to, we are informed that this establishment furnishes only a fraction of the thread consumed in the United States alone.

A spool of cotton appears a simple thing, but when it is considered that the thread, which is so even and so strong, is composed of six cords; that the filaments which compose each cord are straightened and made parallel and twisted; that two such cords are united and twisted together, and that three of the double cords are twisted to form a complete thread, it becomes a matter of wonder that it can be profitably done for the price at which the thread is afforded to the consumer.

The machinery of the Clark Thread Works is driven by two double Corliss engines of about 500 horse power each, and several smaller engines, the power amounting to about 1,400 horse power. The engines, as well as all of the other machinery about the establishment, are in perfect order and of the finest quality.

The cotton, as it comes from the bales, passes through machines called pickers, which pick it up loosely, removing burrs, dust, and other impurities by means of a vacuum. From the pickers it passes to the lap machines, where it is similarly treated and well flattened and compactly rolled up into laps preparatory to passing through the carding machines. In the carding machines, which are shown in the upper right hand view in the engraving (front page), the fibers are further cleaned, combed, and broken, and delivered in a narrow unbroken ribbon, called the sliver, to tall cans, in which, by ingenious mechanism, it is coiled. The filled cans are conveyed to the ribbon lap machines, where a number of the ribbons are united in a single lap several times wider than the single ribbon. These laps or rolls are now conveyed to the French combers, which, with perhaps the exception of the spooling machines, are the most interesting of all the machines used in thread manufacture. They are intermittent in their action, and comb out all the short staple, leaving only the long fibers to be worked into the thread. The sliver, as it passes from the combers, looks delicate and gauzy, more like a spider's web than anything else. The machine handles it delicately, and brings it together in a narrow ribbon and coils it in the cans. This operation, which is represented in the upper left hand view in the front page engraving, is of the greatest importance, as it removes the short fibers and arranges the long ones to the best advantage.

The ribbon is next drawn and twisted in the drawing frames, and is afterward further twisted in two separate machines before spinning, and is wound upon large spools, which are carried to the spinning mules, shown in one of the lower views in the engraving. In each of these machines there are several hundred spindles, which revolve very slowly as they are carried forward by the carriage in winding the thread on the spindle, but revolve with great speed as the carriage draws back in the operation of spinning. The spinning mules are entirely automatic in their action; the attendant has only to repair the broken threads, of which there are not many. From the spinning mules the cops go to the cop winders, where two strands are wound together on a single spool. These two strands are twisted in the machine shown in the small circular figure. The bobbins revolve at a speed of about 5,000 revolutions per minute, and the thread is wound on the bobbins by a simple differential arrangement.

Three of these double strands are twisted together, making the well known six-cord spool cotton, for which this company are justly celebrated.

The spools from the twisting machines are conveyed to the reeling machines, shown in the large central figure,

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where the hanks are formed. When removed from these machines the hanks are inspected by experts, who, by long practice, are enabled to detect a very small variation in the size of the thread, or any other imperfections.

While the thread is in hanks it is passed to the bleaching house, where it is bleached twice, being subjected during the process to a thorough soaping. After bleaching, the hanks are dried and passed to the hank winding machine, where the thread is wound on large spools preparatory to spooling. The spools, we are informed, are made in Maine, it having been found that they could be made and shipped cheaper than the wood could be shipped and worked at the manufactory.

The spooling machines, which are shown in one of the lower views of the engraving, seem the very embodiment of ingenuity. They take the spools, hold them between centers, revolve them, start the thread, wind it back and forth with the utmost precision, making allowance for the beveled ends, stop when the required amount is wound, nick the spool, put in the thread, cut it off, and release the spool, all without attention. All that is required of the attendant is to see that thread is supplied, and to keep the hoppers full of spools.

The tickets which are placed on the ends of the spools are printed in the establishment, two steam lithographic presses being employed for the purpose. The bronze is applied to the tickets by a bronzing machine, and they are gummed and punched by hand.

The tickets are very rapidly applied to the spools by girls, who hold a small package of them in one hand, passing them one at a time into one side of the mouth, while they are taken by the other hand from the other side of the mouth and applied to the spools. By continued practice the hand becomes very dexterous.

The boxes which contain the spools are made by an army of girls, and the label and other printing is done in a printing office containing two Hoe cylinder presses and two other small presses.

The Clark thread is well known throughout the world, and the familiar trade mark, O. N. T., is the guarantee of a good article.

The New York office of Messrs. Clark is on Broadway, at Walker Street.

THERAPEUTIC MACHINERY.

We herewith give illustrations from *Engineering* of some very interesting machines exhibited by Messrs. Goransson & Co., of Stockholm, at the recent Paris Exhibition. These machines are intended for use in surgical gymnasia. The machine shown in Fig. 1 is intended for the development of the muscles of the wrist and arm, and is worked by means of the handle mounted on the spindle which carries the upper of two pulleys at the top of the frame. A crossed belt passes to a second pulley, on the axis of which is a crank that gives motion to a longlever hinged to a separate standard, and carrying a sliding weight by means of which the strain on the operator's wrist can be varied at will. The machine represented in Fig. 2 is specially intended for developing the muscles of the chest and back. The patient sits upon the stool in front of the machine, the height of which can be regulated at will; he then places his arms in the crutched rests, his back being toward the machine, and the latter is then started. Motion is imparted to the rests, which alternately recede and advance, as also does the padded lever below, the function of which is to exert a pressure against the patient's back, at the same moment that the rests recede, with the result of expanding his chest. The arrangement of the machine permits of the most minute adjustment for regulating the degree of expansion and speed of working.

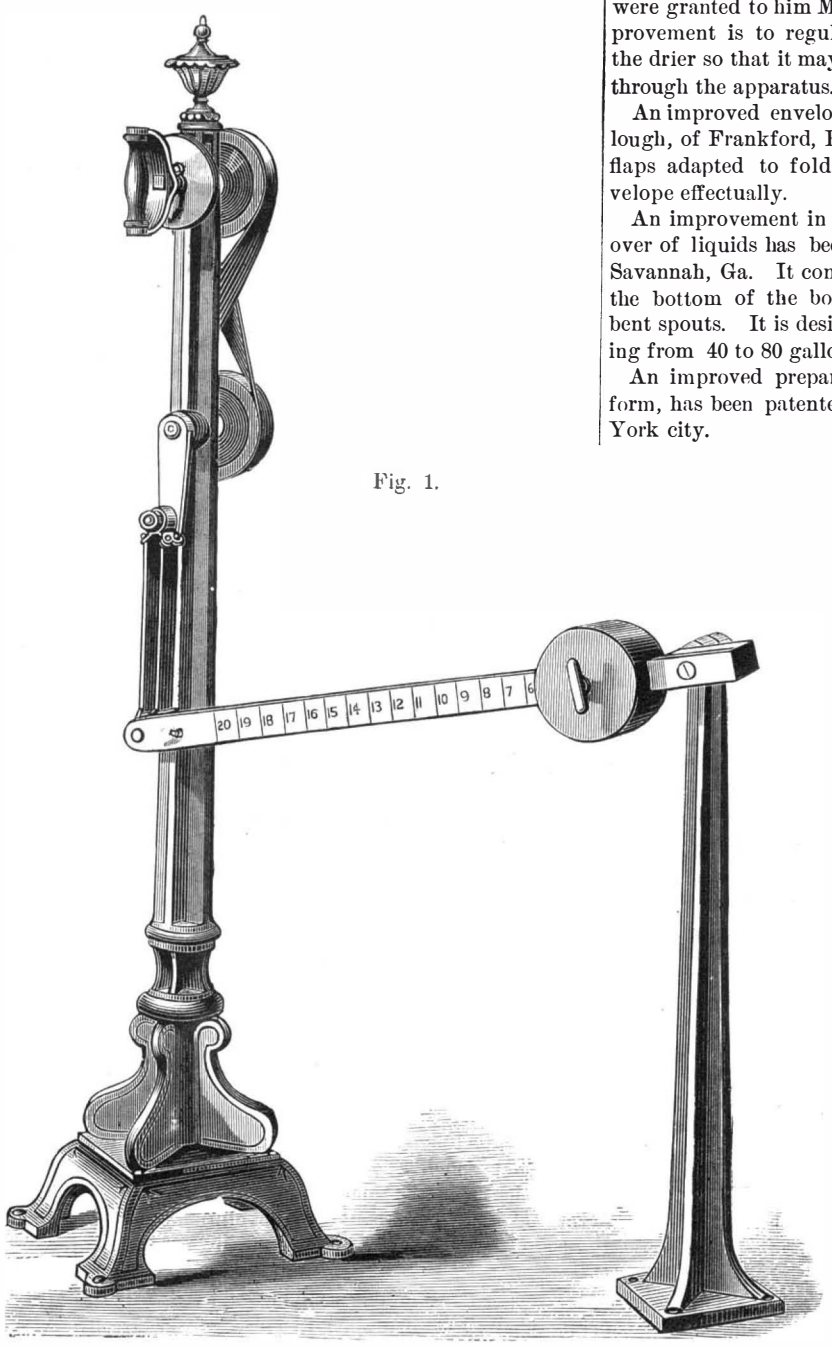

Fig. 1.

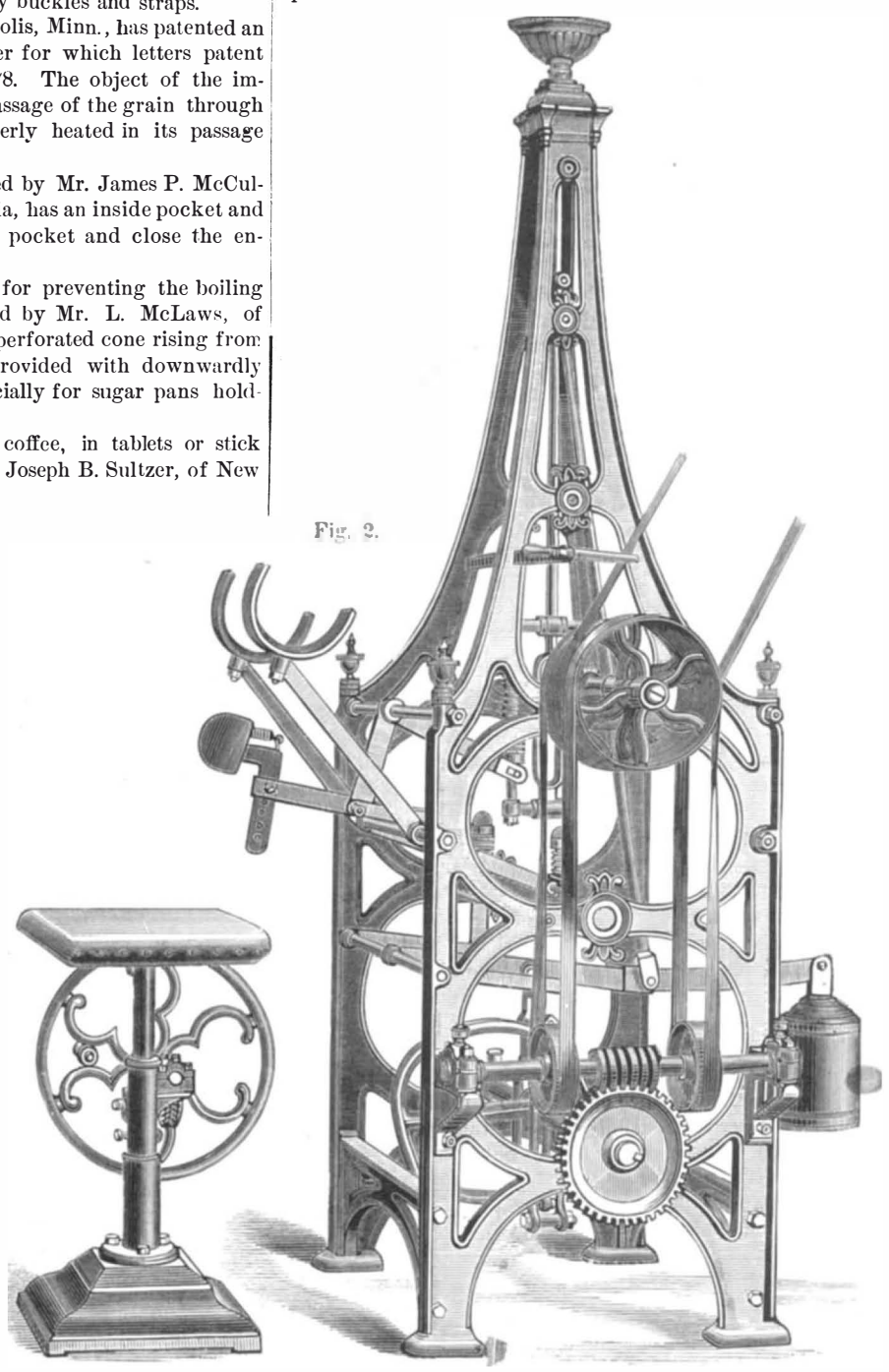

Fig. 2.

MISCELLANEOUS INVENTIONS.

Mr. Albert Back, of New York city, has patented a design for neck ruching, in which a new ornamental effect is secured by giving it two or more folds, arranged so as to present parallel sides running in the direction of the length of the ruching.

An improved roofing composition, recently patented by Mr. Joseph E. Bowen, of Leavenworth, Kansas, has a coal tar base, combined with other ingredients, that render it efficient and durable.

An improvement in cabinet bedsteads, in which the detachable head board and its base are combined with a rod which forms the axial support for the upper end of the folding bed frame, has been patented by Mr. Mark Crosby, of Wakefield, Mass.

An improvement in sounding boards for upright and other pianos has been patented by Mr. Albert H. Wood, of New York city. The object of this invention is to prevent the escape of vibrations, and to utilize to the greatest extent the vibrations of the strings.

A blinder for taming and restraining vicious cattle has been patented by Mr. Byron W. Webster, of Acra, N. Y. It consists of a metallic plate united to a U-shaped wooden piece which is secured in place by buckles and straps.

Mr. Peter Provost, of Minneapolis, Minn., has patented an improvement on the grain drier for which letters patent were granted to him May 21, 1878. The object of the improvement is to regulate the passage of the grain through the drier so that it may be properly heated in its passage through the apparatus.

An improved envelope, patented by Mr. James P. McCullough, of Frankford, Philadelphia, has an inside pocket and flaps adapted to fold inside the pocket and close the envelope effectually.

An improvement in apparatus for preventing the boiling over of liquids has been patented by Mr. L. McLaws, of Savannah, Ga. It consists of a perforated cone rising from the bottom of the boiler and provided with downwardly bent spouts. It is designed especially for sugar pans holding from 40 to 80 gallons.

An improved preparation of coffee, in tablets or stick form, has been patented by Mr. Joseph B. Sultzer, of New York city.

Mr. E. E. Hawkins, of New Lisbon, N. Y., has patented an improved whip socket, which is formed of wire coiled spirally, with its upper and lower coils closed together for receiving pieces of rubber for holding the whip.

Mr. William A. Bradford, of Goshen, Ind., has patented an improvement in school desks, in which the wooden slats forming the seat are secured by a cheap and novel fastening.

A cotton bale tie, in which the ordinary tie loop or buckle is used in connection with a fastening wedge, has been patented by Mr. Henry A. Burr, of Wilmington, N. C.

An improvement in dental forceps, in which the forceps, with the exception of the inside of the jaws, are covered with a non-conductor of electricity, has been patented by Mr. Amase Cobb, of Beloit, Ohio. The forceps are used in connection with a galvanic battery.

Mr. R. E. Miles, of Louisville, Ky., has patented an improved breast collar, which may be readily adjusted to any sized neck and allows great freedom to the motion of the horse.

An improvement in Venetian blinds, which consists in a novel mode of connecting the slats and a new arrangement of cords for operating the slats, has been patented by Mr. Thomas Langdon, of Castroville, Cal.

Mr. Henry N. Rawson, of Brattleborough, Vt., has devised an improved renovator for cleaning and renovating feathers, horse hair, and similar material, by exposing it to the action of steam. The apparatus cannot be clearly described without an engraving.

An improved fire escape ladder, devised by Mr. Joseph R. Winters, of Chambersburg, Pa., is designed to carry the fire engine hose as well as to afford a means of escape from burning buildings. It is strong, simple, and effective.

An improvement in portable railway tracks has been patented by Mr. Joseph Morgan, Jr., of Wilmington, Del. The invention consists in combining shoes made of channel shaped iron with the rail sections, so as to lock them securely together, and still admit of readily separating the sections.

Mr. Jacob Simonson, of Newark, N. J., has patented an improved railway platform guard, designed to protect passengers against falling or being pushed upon the track. It is readily folded out of the way to permit passengers to pass from the platform to the cars.

An improved steam railway brake has been patented by Messrs. J. F. Waite and S. Gavit, of Tyrone, Pa. It requires no brake couplings and it is always in condition to operate.

THERAPEUTIC MACHINERY.

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Dr. Isaac Hays.

Dr. Isaac Hays, for fifty-two years editor of the *American Journal of Medical Sciences,* died at Philadelphia, April 13. Although eminently successful as a practitioner, Dr. Hays' reputation rests almost exclusively upon his connection with medical periodicals and his contributions to transactions of the numerous learned societies of which he was a member, at home and abroad.

Dr Hays joined the Academy of Natural Sciences in early life, and was always an active member, serving as president from 1865 to 1869. He was also one of the original staff of Willis' Hospital, filling the position of surgeon in that institution from its organization until about 1857. In 1830 he was elected a member of the American Philosophical Society, and subsequently curator, and up to the time of his death was a member of its Board of Councils. He was the oldest living member of the Franklin Institute, of which he was one of the founders, and for a number of years its secretary, and was also prominent in the foundation of the American Medical Association, of which he was the first treasurer, serving in that capacity for a number of years. Dr. Hays was chairman of the Building Committee of the College of Physicians, and it was principally through his efforts that the present building at Thirteenth and Locust streets was erected.

Besides contributing to the periodicals with which he was connected, Dr. Hays was also a contributor to the Transactions of the American Philosophical Society, one of his latest being a paper on the occasion of its recent centennial anniversary, and the author of the Code of Ethics adopted by the American Medical Association in 1847, and since adopted by every State and county medical association in the United States. Among his principal literary labors was the editing of Hall's edition of Wilson's "American Ornithology," Philadelphia, 1828; Hoblyn's "Dictionary of Medical Terms," etc., 1846; a new edition of the same, from the last London edition, 1855; Lawrence's "Treatise on the Diseases of the Eye," 1847, and successive editions; and Arnott's "Elements of Physics," 1848.

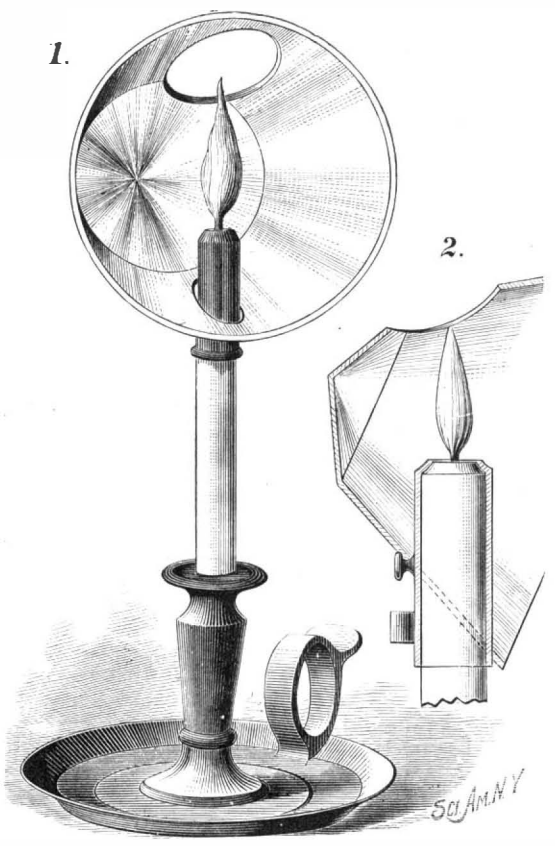
Dr. Hays was born in Philadelphia, July 5, 1796, and was the oldest living editor in continuous service in America.

Five Thousand Dollars to find out the Distance of the Sun from the Earth.

At the meeting of the National Academy of Sciences in April last, a resolution was adopted authorizing the appointment of a committee to consider a plan proposed by Professor Newcomb for determining the distance of the sun by measuring the velocity of light. The members of the committee were: President F. A. P. Barnard, Professors Wolcott Gibbs, Henry Morton, George F. Barker, and E. C. Pickering. Their report was so favorable to the plan proposed that it was sent to the Secretary of the Navy for transmission to Congress. An appropriation of five thousand dollars for the required purpose was thus secured, and the work of constructing the necessary apparatus will be commenced as soon as the appropriation is available. The expenditure of the funds is intrusted to the Secretary of the Navy. In the act of Congress establishing a National Board of Health, which became a law in March last, the Academy is requested and directed to cooperate with this board, and report to Congress at the next session. A communication was received from the president of the board April 15, inclosing a certified copy of the act, and requesting the Academy to appoint an agency with which the board will confer to carry out the provisions of the law.

REFLECTOR FOR CANDLES.

The accompanying engraving shows a novel device, recently patented by Mr. M. C. Meigs, of Washington, D. C., for utilizing the light from a candle. The invention consists in a cap, or partly closed tube, carrying a small reflector; the cap being of the proper size to receive the end of the candle. As the candle burns down the metallic cap settles down and keeps the reflector always in the same position in relation to the flame.



MEIGS' REFLECTOR FOR CANDLES.

The reflector is supported in such a position as to throw the whole or greater portion of the light in parallel rays in one direction.

NEW HYDRAULIC GRID.

We annex illustrations of a new arrangement of hydraulic grid, which has been lately brought out by Messrs. Clark and Standfield, of Westminster. This grid is especially suited for use on the banks of tidal rivers and other places where there is a large rise and fall of tide, and also for use in wet docks and tidal basins, provided it can be constructed before the water is let into the dock. In such cases Messrs. Clark and Standfield consider that it may be constructed at about one half of the cost of an ordinary graving dock. It can also be advantageously used in deep water, but at a somewhat increased cost, and whereas floating and other docks require 10 feet or 15 feet extra depth below the bottom of the vessel, the grid requires only an additional depth of 2 feet, and is thus especially useful in shallow docks and places where the depth of water is limited. In the arrangement now illustrated, the vessel is raised by a row of hydraulic presses sunk in the ground directly under the center of the grid and the keel of the vessel, with a few additional presses at the sides under the shoring frames to keep the grid level and give transverse stability. They are divided into three groups, with an equal number of presses in each group; one group supports one third of the length of the vessel, and the other two groups support the remaining two thirds, one of them controlling the port and the other the starboard side, so that the vessel may either be maintained level or put on an uneven keel at pleasure. The grid is a strongly built longitudinal wrought iron girder directly under the keel of the vessel, with ribs projecting from each side to carry a working platform. Some of the central ribs carry side shoring frames, which are used in conjunction with the sliding keel blocks.

In using the dock the grid and presses are lowered to the bottom, and the keel of the vessel is brought directly over the center and secured in position by the bilge blocks and side shoring frames, the presses are then worked and the vessel lifted till the grid is above high water mark. When in this position a number of struts or swinging frames (which were previously held up in a horizontal position under the grid) are liberated and allowed to hang in a vertical position. The grid is now lowered a few inches until the whole of these struts rest on raised bearings cast on the head of the presses, and the whole weight of the vessel and grid rests on them. The rams are now allowed to sink down into the presses, where they remain in fresh water, and are consequently not exposed to rust. The supports are hinged or swung at the top so as to fall accurately into their places, and suitable means are provided for raising and lowering them simultaneously by means of chains and shears. These frames are of considerable breadth, and some of them swing transversely and others longitudinally, so as to obviate any tendency of the grid to move in either direction. There are also, in addition, strong cast iron columns, with guides, against which the grid slides as it rises and falls. The pumps, pipes, and valves are similar to those used in ordinary hydraulic docks, and the method of working them is so well understood as to require no description.

The advantages of the hydraulic grid arise from its economy in first cost and the small weight of material required. The rams are applied directly beneath the vessel, and in consequence of this the transverse girders which carry the pontoon and vessel, the lifting chains, the tall guide columns, and the pontoon can be dispensed with, and their place supplied by a simple pontoon girder or grid and a few guiding columns. Perhaps the most important of the new features in the dock is the automatic safety valve for insuring that the grid shall at all times remain perfectly level. The action of this arrangement is such that it is impossible to raise or lower one corner of the grid without equally raising or lowering the others.

This dock is, of course, perfectly well suited for the use of pontoons of the usual character, and the only objection to their introduction lies in the fact that the pontoon would cost as much as an additional dock. Fig. 1 shows an end elevation, Fig. 2 a side elevation, and Fig. 3 a plan of one of these grids erected on the side of a tidal river.—*Engineering.*

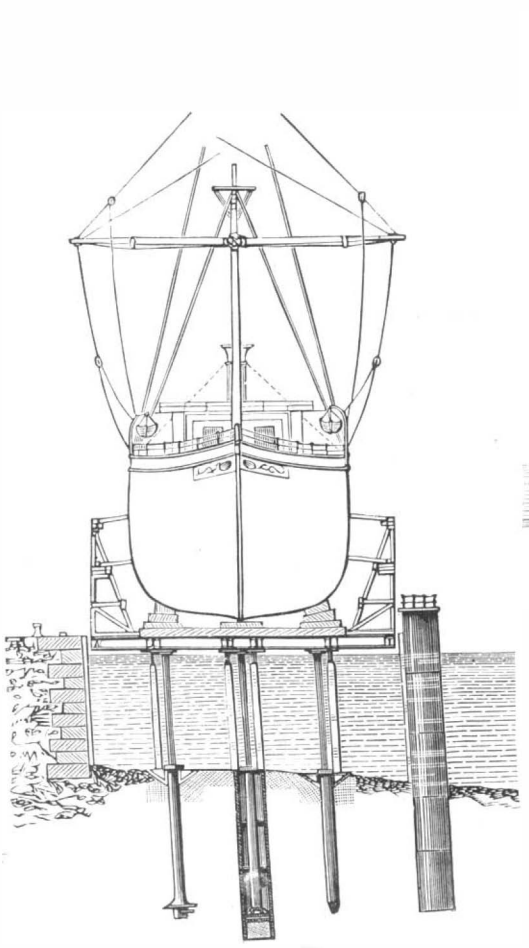


FIG. 1.

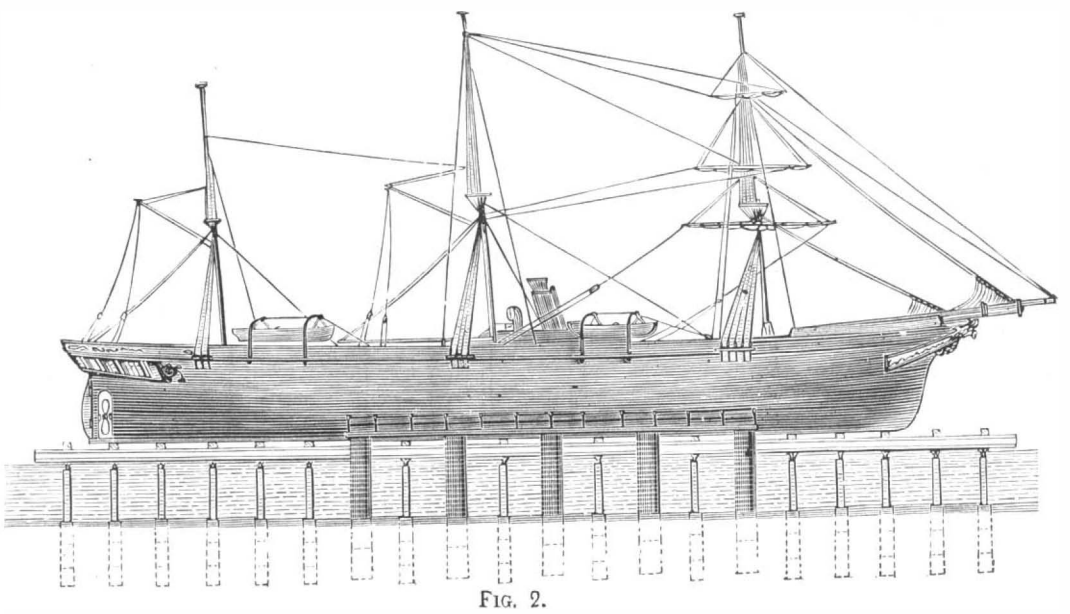


FIG. 2.

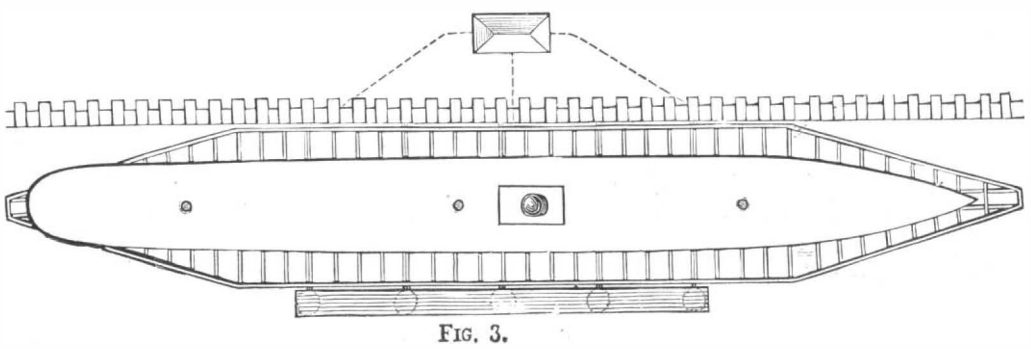


FIG. 3.

NEW HYDRAULIC GRID.

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Pain and the Weather.

In his paper on the relation of neuralgic pain to storms and the earth's magnetism, read before the National Academy of Sciences, Professor S. Weir Mitchell reported the following observations:

Captain Catlin, U. S. Army, lost a leg during the war, and since that time has suffered from traumatic neuralgia, sometimes in the heel, but more frequently in the toes, of the foot. He has carefully noted the effects produced on himself by changes of the weather. Dr. Mitchell's own studies in this case, as he says, "would never have proved successful had it not been for the unusual ability, interest in the task, and perseverance of the accomplished gentleman who has obliged me by making his own torments useful in the solution of the question of how far weather effects the production of certain kinds of pain." The hourly observations cover a period of five years. "For the first quarters of these five years there were 2,471 hours of pain; for the second quarters, 2,102 hours; for the third quarters, 2,056 hours; and for the last quarters, 2,221 hours. The best yield of pain is in January, February, and March, and the poorest in the third quarters, July, August, and September. During these five years, while the sun was south of the equator, there were 4,692 hours of pain against 4,158 hours while it was north of the equator; and the greatest amount of pain was in the quarters beginning with the winter solstice, and the least was in those beginning with the summer solstice. The average duration of the attacks for the first quarters was 22 hours, and for the third quarters only 17·9 hours.

By taking the four years ending January 1, 1879, it is found that of the 537 storms charted by the Signal Bureau, 298 belong to the two winter quarters, against 239 for the summer quarters. Hence we have the ratio of the number of storms of the winter quarters and summer quarters corresponding to the ratio of the amounts of neuralgia for these respective periods, and the ratio of average duration of each attack for the same time corresponds closely with the ratio of the respective total amounts of neuralgia for the same periods. The average distance of the storm center at the beginning of the neuralgia attacks was 680 miles. Storms coming from the Pacific coast are felt furthest off, "very soon after, or as they are crossing the Rocky Mountains," while storms along the Atlantic coast are associated with milder forms of neuralgia, and are not felt until the storm center is nearer. Rain is not essential in the production of neuralgia.

It was found that the severest neuralgic attacks of the year were those accompanying the first snows of November and December. One of the most interesting and valuable results of this series of observations is thus stated: "Every storm, as it sweeps across the continent, consists of a vast rain area, at the center of which is a moving space of greatest barometric depression, known as the storm center, along which the storm moves like a bead on a thread. The rain usually precedes this by 550 to 600 miles, but before and around the rain lies a belt which may be called the neuralgic margin of the storm, and which precedes the rain about 150 miles. This fact is very deceptive, because the sufferer may be on the far edge of the storm basin of barometric depression, and seeing nothing of the rain, yet have pain due to the storm.

A NEW LOCOMOTIVE.

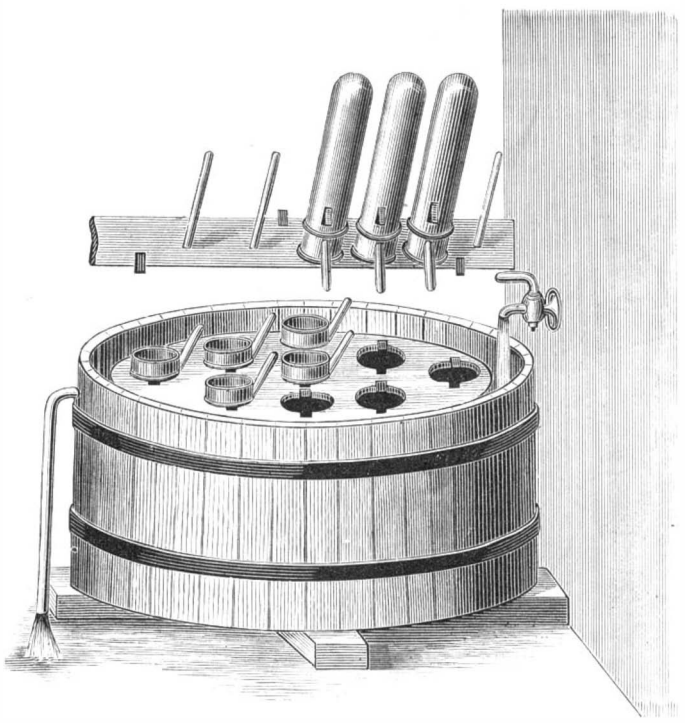
The accompanying sketch shows the plan of a small locomotive designed and constructed by the Baldwin Locomotive Works, Philadelphia, Pa., especially for sugar plantations and other similar service, where it is desirable to use either wood or coal as fuel. Having six wheels it is quite steady on the track, and moves along smoothly without plunging and without undue wear either in itself or in the track. It will be noticed that the fuel and water are carried at the back of the engine by the pony truck; by this arrangement the distribution of weight is made as nearly perfect as possible, and the center of gravity is kept low. The weight of the boiler and machinery is carried on equalizing levers midway between the driving wheels, so that the weight is equally distributed on the four driving wheels. This arrangement renders it impossible for an excessive weight to come upon any one wheel. It is never necessary to turn the engine, as the engineer can have a good view in either direction. One of the most important features of this engine is that it is carried on three bearing points only, and is therefore peculiarly adapted to a rough, uneven track, such as is usually found on a logging railroad, and it is capable of passing curves much more readily than a four or six wheeled connected engine, the pony truck under the tank being provided with a swinging bolster and radius bar which leads the engine to a curve when running ahead.

No wood is used in the construction of the engine excepting the bumper beam, cab, and floor. The general arrangement of the parts admits of a large fire box, which is required for burning wood, and if necessary a rack may be placed around the water tank for holding wood. The manufacturers inform us that the style of engine may have a separate tender, and the truck may have four wheels instead of two, if preferred.

MILK COOLER.

Our engraving shows the Austrian mode of cooling milk, which is very simple and, in some respects, novel. It consists of a vat or tub through which cold water is constantly circulating. On the surface of the water floats a circular wooden plate, provided with a number of round holes, into which are inserted the vessels containing the milk. These are made of sheet zinc, two feet long, and each, according to the *Wiener Landw. Zeitung*, contains a little over a gallon of milk.

It takes about fifteen minutes to cool the milk down to a temperature slightly above that of the surrounding water. When not in use the cylinders are turned upside down, on a wooden rack, as shown in the engraving, to drain and dry.



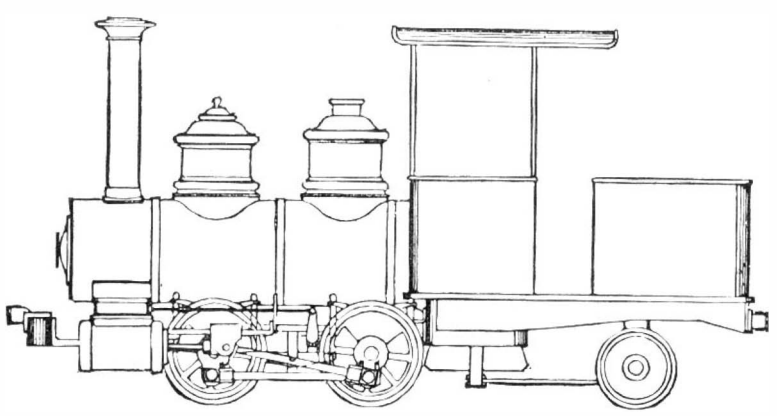
THE VIENNA MILK COOLER.

Cheap Freighting.

The transport of Pittsburg coal to the towns along the Ohio river is described as the cheapest freight transport in the world. The *Commercial* of Louisville, Kentucky, tells how the business is managed.

In and about Pittsburg there are 50 operators or firms engaged in the coal business; about one half of whom sell at the mines, the other half are shippers engaged in running coal to southern ports. The shipments for Southern consumption from Pittsburg amount annually, on an average, to 80,000,000 bushels of coal and 20,000,000 of coke, which is sent south by the shippers on the tides as they occur. For this purpose they employ 96 tugs or tow boats and about 1,500 barges and shells in which the coal is transported. Each barge costs about $1,000 and carries from 12,000 to 13,000 bushels. The shells cost about $500 and they carry about 24,000 bushels. The barges, when unloaded at their destination, are returned to the mines; the shells are generally sold in the South and broken up for other uses by the purchasers. On an average there are ten coal tides or rises at Pittsburg during the year, which occur suddenly, and frequently last only from 24 to 36 hours. The barges and shells must, therefore, be kept loaded and ready for departure at an hour's notice. When the opportunity arrives, the tows are lashed to the tugs, each taking about 10 barges, containing, say, 150,000 bushels of coal, the great length of the tows and the short time allowed by the rapidly falling river requiring the most expeditious movements.

By this admirable barge system coal is kept at a price but little above that of Pittsburg to the cities above the falls of the Ohio, the expenses of running the coal to Louisville, including the cost of returning the barges to the mines, being only about 1½ cent per bushel.



SMALL SIX-WHEELED LOCOMOTIVE.

Discovery of Male Eels.

We are glad to state that finally what we believe to be genuine male eels have been discovered. In the January number of this journal it was announced by Prof. Packard that he had discovered male eels. A number of the supposed males were afterward again examined, by Prof. Packard and Dr. C. S. Minot, who were then led to conclude that the so called male eels were immature females, and the mistake was corrected by Prof. Packard in the February *Naturalist*. A large number of living eels were then examined by Messrs. Packard, Kingsley, Pierce, and Minot without success, until at Prof. Packard's request Mr. Kingsley spent a few days at Wood's Holl, at the laboratory of the U. S. Fish Commission, in the last of February, examining living eels supplied by Mr. Vinal N. Edwards, by favor of Prof. Baird, U. S. Fish Commissioner. One hundred and ninety-three eels were there examined, and of these three were found by Mr. Kingsley to be, in his opinion, males. His observations made on these living individuals, which were speared in a pond through the ice, are as follows:

"On February 18, 19, and 20, I examined one hundred and ninety-three eels, at Wood's Holl, and found three males, the testes of which agreed closely with Syrski's figures as reproduced in the U. S. Fish Commission Report for 1873–4 and 1874–5, p. 719. Although I made careful examination I could find no external characters to separate the sexes. The three males were each about seventeen inches long, while the females examined varied from about twelve inches to nearly three feet. This average length of males agrees closely with Syrski's (430 mm. in length). The principal criticisms I would make of his figures, or rather points of difference that I found, are that his enlarged figure showing the lobulation of the testis has the lobes far more crowded than they were in the specimens I examined. His drawing of the histological structure was greatly larger than what I supposed to be the same. His cells measure, according to the explanation, about $\frac{1}{440}$ of an inch on their major axis, while I saw nothing that could have been over $\frac{1}{4000}$ of an inch. The structure of the testis was similar to that which I have seen in the testes of the cod, perch, smelt, cat, deer, rooster, monkey, dog, and man. On teasing it out under a Tolles one fifth, I saw what I am confident were spermatozoa, although I could not distinguish the tails. The heads were oval and from one half to one third the size of those of the smelt, or about $\frac{1}{20000}$ of an inch in length; they had an independent motion, changing their position on the slide without reference to any current in the water in which the tissue was placed, and this motion was wholly different in its character from the vibrations of the Brownian movement."

Prof. Packard examined, independently of and in company with Mr. Kingsley, preparations made by himself, and found scattered through the tissues, nucleated and nucleolated testis cells, of the same appearance as those of the animals above named, which were kindly obtained by Prof. Pierce. Moreover, Prof. Packard, found two mother-cells, containing several immature nucleated spermatozoa. So that after the examination of about five hundred female eels and three males, we are glad to be able to affirm the entire accuracy of Syrski's observations and figures, he being the first observer, so far as we are aware, who has discovered the male sex of the Italian eel. Which species of eel it was that Syrski examined is not stated. In making these investigations we have to acknowledge the aid of Prof. John Pierce, of Providence, in the use of a fine series of mounted histological specimens and lenses of high powers. He has worked jointly with us, and is of our opinion as to the sex of the three males. Dr. Minot examined one of the three males, preserved in alcohol, and found, as Freud and Brock had done previously, a follicular structure, the follicles being filled with small spherical cells, which Dr. Minot considered to be probably immature spermatozoa, although the development could not be traced.—*Advance proof from American Naturalist for May.*

Singular Action of Pilocarpine.

According to the *Pharmaceutical Journal*, a singular action of pilocarpine has recently been made known by Dr. G. Schmitz, of Cologne. In the course of his ophthalmic practice, Dr. Schmitz had two cases in which the patients were bald, and found that after the use of subcutaneous injections of hydrochlorate of pilocarpine (with the object of causing absorption of inflammatory residue within the eye) the scalp rapidly became covered with young downy hairs. In one of these cases a man sixty years of age had his head covered in four months, partly with gray and partly with black hairs of considerable growth, so as quite to hide his previous baldness. If this stimulant action on the hair bulbs be proved to generally follow the use of jaborandi or its alkaloid (pilocarpine) a rapid increase in the demand for the latter may soon be expected.

A SPRINKLING of lime, plaster, or sulphur over the leaves of the strawberry at the first appearance of the blight, is suggested as a remedy for this disease, which has made such sad work with the foliage of this delicious berry.

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ENGINEERING INVENTIONS.

An improved pump, having a hollow piston provided with valves, connected with the supply and discharge pipes, and having a cylinder which is reciprocated by a lever handle, has been patented by Messrs. J. Y. Wren, C. Wren, and G. R. Wren, of Plymouth, Pa.

Mr. James L. D. Wolfe, of Windsor, Nova Scotia, has invented an improved ship's pump, in which the piston is reciprocated by a right angled lever operated by a grooved cam.

An improvement in sharpie boats has been patented by Mr. T. Clapham, of Roslyn, N. Y. It is provided with an attachment piece arranged below the water line, and extending from the stem to amidships, to prevent spanking and to enable the boat to always go "in stays."

An improved machine for making open ditches for tile drains and other purposes has been patented by Messrs. James A. Grant and Thomas McClelland, of Mount Pleasant, Ohio. It is mounted on wheels, and operated by drawing it along in the field like an ordinary wagon.

Mr. John McLucas, of Redfield, Iowa, has patented an improved turbine water wheel, which may be arranged on either a vertical or horizontal shaft. It is provided with peculiar chutes and buckets, which cannot be clearly described without an engraving.

ROWELL'S IMPROVED LENS FOR SPECTACLES.

We illustrate herewith an improvement in lenses for spectacles, recently perfected and patented by Mr. J. R. Rowell, of Hill, N. H. Although the improvement is very simple in its character, it is said that it makes a wonderful difference in vision. The lens has two foci, and is therefore capable of forming two distinct images. This peculiar feature will be more readily understood by reference to the engraving, in which Fig. 1 shows the lenses complete mounted in a spectacle frame in the usual way.

In Fig. 2 is shown a diametrical section of the lens, and the direction of the light rays is shown by dotted lines. Fig. 3 is a diametrical section of an ordinary lens.

It will be noticed that in the improved lens the central portion is of long focus, converging the rays at *a*, while the annular portion is of comparatively short focus, converging the rays at *b*.

Mr. Rowell tells us that this lens is adapted to any eye that would be suited by an ordinary lens focusing at any point between *a* and *b*, and that it requires only five sizes, or five different lenses, to fit all eyes met with in the ordinary practice of the optician.

Another feature claimed by the inventor as important is that the field of vision appears to be amply illuminated, and that vision is far more distinct than with ordinary lenses.

Fig. 1

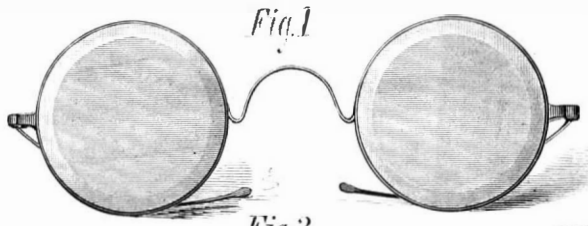


Fig. 2

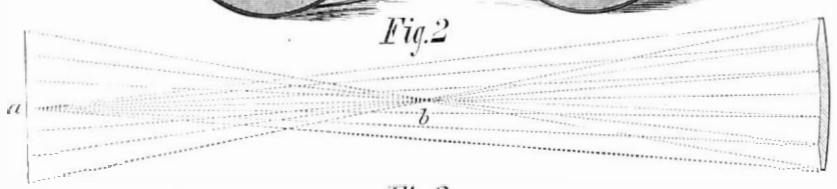
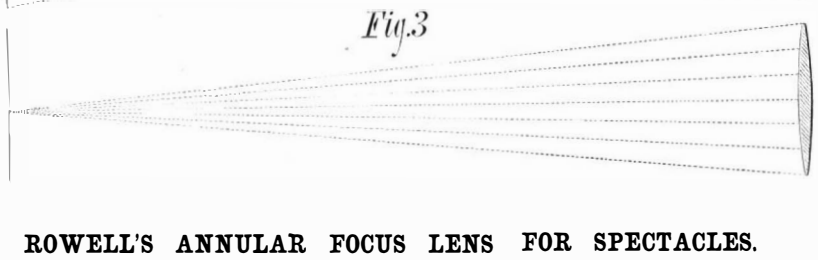


Fig. 3



ROWELL'S ANNULAR FOCUS LENS FOR SPECTACLES.

The Black Mildew of Walls.

At a meeting of the Philadelphia Academy of Natural Sciences, September 3, Professor Leidy remarked that in Hardwicke's "Science Gossip," there is an article by Professor Paley entitled "Is the Blackness of St. Paul's merely the Effect of Smoke?" According to the author of the article, the blackness is mainly due to the growth of a hitherto undescribed lichen, which appears to flourish on limestone and in situations unaffected by the direct rays of the sun. Professor Leidy said that his attention had been called a number of years ago to a similar black appearance on the brick walls and granite work of houses in narrow shaded streets, especially in the vicinity of the Delaware river. Noticing a similar blackness on the bricks above the windows of a brewery, from which there was a constant escape of watery vapor, in a more central portion of the city, he was led to suspect that it was of a vegetable nature. On examination, the black mildew proved to be an alga, closely allied to what he supposed to be the *Protococcus viridis*, which gives the bright green color to the trunks of trees, fences, and walls, mostly on the more shaded and northern side, everywhere in the vicinity of Philadelphia. It may probably be the same plant in a different state; but, until proved to be so, may be distinguished by the name of *Protococcus lugubris*. It consists of minute round or oval cells, from 0·006 to 0·009 mm, in diameter, isolated or in pairs or groups of four, the result of division; or it occurs in short, irregular chains of four or more cells up to a dozen, occasionally with a lateral offset of two or more cells. The cells, by transmitted light, appear of a brownish or olive-brownish hue. In mass to the naked eye the alga appears as an intensely black powder.

CATILLON, a French physiologist, found that the addition of from seven to eight grains of glycerine to the daily ration of a lot of Guinea pigs increased the effect of their food so that they gained from one-tenth to one-fifth of their weight in a given time, while a second lot fed on the same ration, but without glycerine, gained nothing; when the dose of glycerine was changed to the second lot they gained in weight, and the first lot gained nothing. Large doses of glycerine, however, cause derangement of the digestive organs.

THE EXPLOSION ON THE THUNDERER.

The bursting of the 35 ton gun on the British war vessel Thunderer, during target practice on the morning of 2d of January last, with the attendant loss of life, was widely noticed at the time.

From the report of the joint committee appointed by the Admiralty and War Office to inquire into the cause of the disaster, it appears that the two guns of the fore turret of the Thunderer and the two guns of the after turret were each loaded with a battering charge of 110 lb. and with an empty Palliser shell. In the case of the fore turret disk wads were used; but in that of the after turret (where the guns, being only of 35 tons weight and of 3 feet less length than those of the fore turret) the guns were loaded by hand from within the turret, and wads were not used, the water being smooth and the guns horizontal. All four guns, being primed with electric tubes, were coupled up electrically so as to be fired from the "conning tower," to deliver what is known as an electric broadside. The target at this time was about 400 yards distant and the ship was under steam. On the firing key being pressed to fire this broadside, although the tube of the right gun in the after turret was exploded by the electricity, the fire was not communicated to the powder in the cartridge, and that gun admittedly made a misfire. The committee have been forced to the conclusion that the left gun of the fore turret also missed fire. After the electric broadside the order was given for independent firing with empty common shell and full 85 lb. charges. Both guns of the fore turret were thus loaded. The right gun was then fired independently; the left gun of the fore turret was then fired and burst explosively. The causes which may have led to the explosion are summarized by the committee as follows:

"(*a*) That the gun being sound, and being used in a normal manner, burst because it was inherently too weak (1.) The weakness arising from faulty design. (2.) The weakness arising from bad materials. (3.) The weakness arising from bad workmanship. (4.) The weakness arising from a combination of any or all of the foregoing causes.

"(*b*) That the gun, not being inherently too weak, had been injured by previous cracks, and was thus rendered unsafe to fire the 85 lb. charge.

"(*c*) That the gun, being neither inherently weak nor previously injured, was burst by the projectile becoming jammed in the gun. (1) Jammed by the wad; (2) jammed by the studs; (3) jammed by the breaking or by the 'setting up' of the projectile.

"(*d*) That the gun being assumed perfect as above, the bursting was caused by an air space being left either between the cartridge and the breech end of the bore, or between the cartridge and the projectile, or by both, such air space being caused—(1) by the charge not having been rammed completely home; (2) by the projectile having come forward, either in consequence of the wad having been withdrawn or being inefficient.

"(*e*) Error in loading—viz., that the gun being assumed perfect, the gun had been loaded with an empty common shell and full charge, and it had been ascertained by the priming wire, after the gun was brought to the horizontal position, that the charge was not home, and that, therefore, the gun was again brought to the loading position for the mere purpose of re-ramming, but the only visible signal between those inside of the turret and those on the battery deck being 'sponge and load,' this signal was literally obeyed, and a second common shell and 85 lb. charge were rammed in on the first such charge, which still remained in the gun.

"(*f*) Also error in loading—viz., that the gun being assumed perfect, the explosive bursting was due to the battering charge and Palliser shell remaining in the gun, owing to a misfire at the electric broadside, and to the insertion into the gun of the full charge and common shell in addition to the battering charge and Palliser shell, and to the gun being fired at the independent round when thus doubly loaded."

The committee unanimously report in favor of the last (*f*) as the true cause of the explosion. The report says:

"Assuming the gun to be fired under these circumstances, the battering charge would be ignited by the tube, and the flame from this, before the expansion of the 'gas check' fully took place, passing forward would almost instantly ignite the full charge. At that time, however, the ignition of the battering charge would have driven the Palliser shell forward, and have violently compressed the full charge in front of it, and probably have driven it somewhat forward in the gun, and thus the point of maximum effort of the exploded compressed full charge would have been just about in the center of the 1 B coil—namely, 90 inches from the breech end of the bore. An explosion of 85 lb. of powder thus compressed and having a shell in front of it occurring in this place would unquestionably be sufficient to burst the gun."

That the second charge was exploded by fire from the first, Prof. Osborne Reynolds thinks highly improbable. In a paper read before the Manchester Philosophical Society he pointed out that the bursting of the gun like a shell in front of the first shoulder implied an enormous excess of pressure at this point of the gun, an action such as might result from guncotton or dynamite, but which could not be produced by the slow burning of pebble powder.

The reason why guncotton is so much more destructive than gunpowder is not that it gives off more gas, weight for weight, but that when ignited by a flash it burns so much quicker. If, therefore, by any means the whole mass of gunpowder in the forward charge had been heated up to the firing point at the same instant, so that the grains fired simultaneously inside as well as out, the action of the powder would have been as quick or quicker than the guncotton. And, still further, if besides being heated the powder was compressed into a fraction of the space it usually occupies, the gases so confined would have been capable of a still greater pressure.

That this was the real condition attending the explosion Prof. Reynolds showed to be altogether probable. He said:

"Now if the after cartridge were fired and the forward cartridge were not ignited by the flash, and considering the length and fit of the shot, it could hardly have been so ignited, then the after shot would be driven forward, closing on to the forward shot and compressing the powder between until the pressure on the forward shot was at least half as great as the pressure of the gases behind the after shot, which would be between ten and twenty tons on the square inch. Thus the powder would be subjected to a squeeze between the two shot such as would result from a blow. It would be compressed to a fraction of its former volume. The cubes would be crushed into a cake and the work of compression would be sufficient to heat the powder beyond its point of ignition. Thus the entire mass of powder would be simultaneously ignited in a highly compressed and heated state. The force of such an explosion would be practically unlimited and would be located at the very point at which the gun burst. Hence in such an action we have ample cause for the effect produced."

To test this theory of the explosion Prof. Reynolds suggested that a 12 inch gun be loaded with a double charge of powder and a double charge of shot, or a shot of double weight, and fired. If, as was probable, the gun did not burst, confidence in the gun would be re-established. Then let the gun be loaded twice over with the powder between the shot so as to ascertain whether the action of the powder when fired by percussion would not produce an effect similar to that which caused the explosion. "The destruction of one gun for the purpose of establishing confidence in all the rest," Prof. Reynolds added, "would not seem to be an unworthy sacrifice."

Geological Survey of Kentucky.

We have received from the Director of the Kentucky Geological Survey, Prof. N. S. Shaler, the following reports: On the Timber Trees of the Tradewater Region, by L. H. De Friese; On the Timbers of the Purchase District, by the same; On the Cumberland River (Limonite) Iron Ores, by Wm. B. Caldwell, Jr.; On Coal Washing for the Separation of Coal from its Impurities, by P. N. Moore.

These reports, particularly the two last named, will be found of value to all interested in the development of the resources of Kentucky. The limonite ores of this State are not only abundant, but particularly valuable for steel making. Coal of excellent quality abounds in the same region.

Antwerp Industrial Exhibition.

Mr. James R. Weaver, United States Consul at Antwerp, informs the Department of State that an industrial exhibition will be opened in Antwerp in August, 1879, which will be worthy of universal attention. Space has been allotted for American products. The consul commends the exhibition to the artisans and producers of the United States. Correspondence may be opened with and consignments sent to S. H. Haine, No. 39 Rue Honblonniere, Antwerp, Belgium, who will take charge of American goods. He has already received a number of consignments to his care from the United States. Goods should be in Antwerp before the first day of August next.

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AN IMPROVED MANGLE.

The principal hinderance to the general introduction and use of mangles in this country has been their cost and their complicated nature. In Europe, notwithstanding the objections, these machines are quite generally used and their utility is acknowledged.

The novel mangle shown in the accompanying engraving is the invention of Mr. Charles Reese, of 345 Madison avenue, Baltimore, Md. It seems to be a marked improvement in this class of machines, as it is without gearing and its parts are few and simple. The iron end pieces or standards support a concave bed, above which a convex presser block is suspended from a shaft at the top of the frame. This shaft may be raised or lowered by means of the lever that projects over the front of the machine. A suitable handle is attached to the front of the presser block, and between the presser block and the bed is placed a roller, around which the cloth to be mangled is wrapped.

The bed and presser may be made either of wood or iron, or a combination of both. If the presser is made of wood it must be weighted to give the required pressure.

The cloth to be pressed is wrapped around the roller, and the presser is raised by means of the lever at the top of the machine. The roller is inserted between the bed and the presser, the latter is let down upon the roller, and the cloth is pressed by swinging the presser back and forth by means of the handle.

This mangle occupies less space than other forms, and is cheaper, and it is claimed that it will do better work with less labor.

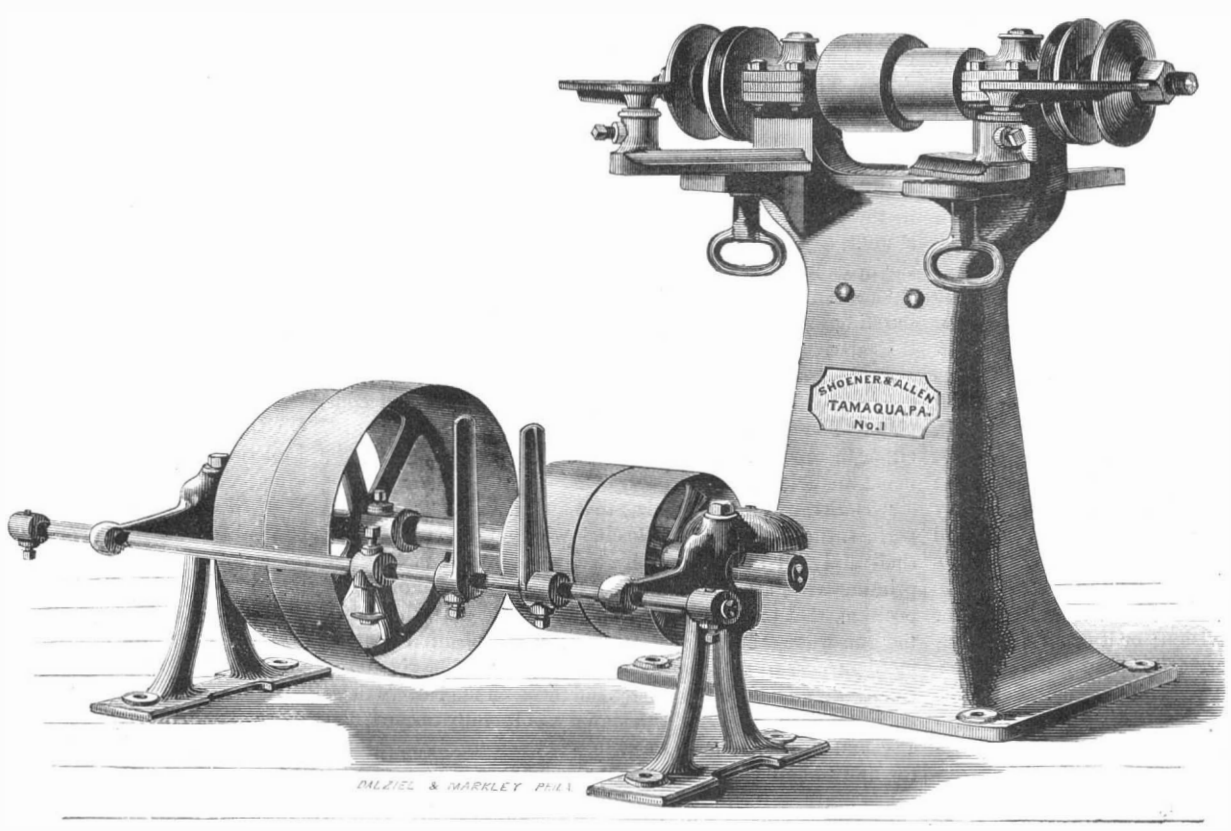
The inventor says that the arms which support the presser block may be extended even to the ceiling of the kitchen or laundry, and that the machine may be made a permanent fixture in the house.

This machine has been patented in this country, also in Canada, England, France, Germany, and Belgium. Any further information in regard to it may be obtained by addressing the inventor as above.

THE RHYSTON MANGLE.

AN IMPROVED EMERY WHEEL STAND.

The saving of files and tools by the use of solid emery wheels, amounting as it does to thousands of dollars annually, is an item to be considered by manufacturers of iron and steel articles. There are few manufacturers of this class who could not in one way or another make use of solid emery wheels, and whatever tends to augment their usefulness will be readily appreciated. In the ordinary emery wheel stand considerable difficulty is experienced from the escape to the periphery of the wheel of the oil used in lubricating the mandrel. To avoid this, Messrs. Shoener & Allen, of 328 Walnut street, Philadelphia, Pa., have devised a concave grooved clamp—the construction of which will be readily understood from the engraving—which flings off the waste oil escaping from the journals and prevents it from creeping upon the stone. The machine has a broad and solid base, and the parts are arranged with a view to the greatest convenience. We are informed that the utmost care is taken in their manufacture; the arbors being of steel well fitted, and the boxes being hand reamed after being placed, to secure perfect alignment, and all of the pulleys are carefully balanced. Any further information in regard to this machine may be obtained from the manufacturers as above.



SHOENER & ALLEN'S EMERY WHEEL STAND.

A Dakota Wheat Farm.

The largest cultivated wheat farm on the globe is said to be the Grondin farm, not far from the town of Fargo, Dakota. It embraces some 40,000 acres, both government and railway land, and lies close to the Red River. Divided into four parts, it has dwellings, granaries, machine shops, elevators, stables for 200 horses, and room for storing 1,000,000 bushels of grain. Besides the wheat farm, there is a stock farm of 20,000 acres. In seeding time 70 to 80 men are employed, and during harvest 250 to 300 men. Seeding begins about April 9 and continues through the month, and is done very systematically, the machines following one another around the field, some 4 rods apart. Cutting begins about August 8, and ends the fore part of September, succeeded by the thrashing, with eight steam thrashers. After thrashing, the stubble ground is plowed with great plows, drawn by three horses, and cutting two furrows; and this goes on until the weather is cold enough to freeze, usually about November 1. There are many other large farms in the Territory and in the same neighborhood, and they are tilled in much the same manner as the Grondin. The surface of the land generally is almost level, and the soil rich and black. The product of one field of 2,315 acres is 57,285 bushels—elevator weight—some 25 bushels to the acre. The average yield of the Dakota wheat farm is 20 to 25 bushels per acre.

A Curious Astronomical Phenomenon.

Under the date of April 13, Mr. Henry Harrison, of Jersey City, sends to the New York *Tribune* the following communication:

"At about 8:30 o'clock last evening, as I was searching for Brorsen's comet, I suddenly hit upon an object which I supposed to be a planetary nebula, very much resembling that near Beta Ursa Majoris, nearly on a line north, between the Pleiades and the variable star Algol. Being somewhat in doubt as to the existence of such a nebula in that region, I started the driving clock, noted the right ascension and declination, which were 2h. 34m. and 37° N., searched the catalogues, but found no such object recorded. By this time I found the object gone out of the field, but soon found it again, when it had gained four min. in R. A., its declination being unchanged. A half hour or so later, watching it constantly with amazement, I found it had gained the same amount. I no longer trusted to my own vision, but called a friend to confirm what undoubtedly was there. He saw it, and we both began to speculate as to its physical composition. A comet it could not be, because of its rapid motion from N. W. to S. E., nor could it have been a cloud, because it maintained not only its shape, diameter and density, but also its luminosity, and in the absence of both sun and moon a batch of cloud viewed with a telescope would have no definition, form, or illumination. Still following it as it slowly swept toward Alpha Auriga, I found that a calculation of R. A. at 9:35 was 3h. 4m., N. D. 37°.

"In order to obtain more knowledge about this wonderful phenomenon, for such I must call it, I concluded to telegraph at once to the Naval Observatory at Washington to set the circles, as I calculated, about 7h. 8m. west of the meridian and declination north 37°, which position it would occupy by the time the message would reach the observatory. Returning from the telegraph office at 10:45, its altitude must have reached a height of 40°. Still it maintained its form and brilliancy. I must say here, that before sending a dispatch to the Naval Observatory, I thought that the object might be a reflection, but this thought was rapidly removed by placing a pasteboard tube of eighteen inches in length over the objective, but onward it moved with independent motion. Even the two-inch finder showed it faintly. At 10:45 I noticed its declination to be 37° 6′; at 11:30 it neared the double star Alpha Geminni, and rapidly passing before a star of the sixth or seventh magnitude, seemed not to obscure the latter, but showed the star almost as brilliant as immediately after its passage. The declination now was 37° 28′.

At 12 o'clock I retired for a short time, after a wearisome chase of nearly three and a half hours. At 2:10 o'clock this morning I found it, after a search of about twenty minutes, in the zenith. It now seemed to be more brilliant than at any previous observation, its declination being now 37° 40′, and I fancied I could see it with the unaided eye, but cannot be positive of this. I must confess, although absurd, the thought entered my mind that one of the planetary nebulæ, tired of its position, was seeking another and a better home."

The Mirror Telegraph.

Mr. H. Baden Pritchard contributes to *Nature* an interesting account of the use made of the heliostat by the English in their campaigns in Afghanistan and Zululand. It is claimed that this is the first application of the mirror as an implement of warfare. Heliostat stations, says Mr. Pritchard, are now established throughout the Khyber Pass, and General Sir Samuel Browne, at Jellalabad, has his orders passed up to him by flashes of light from Peshawur and Ali Musjid. Lord Chelmsford has of late also been furnished

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with heliostats, in order to provide him with better means of communication along the Tugela. The plan of working is very simple. The mirror of the heliostat is placed so as to reflect the sun's image to a distant station, and when the instrument has once been set, the clockwork arrangement suffices to maintain the mirror in its proper position. In this way the distant station in question always sees the dazzling ray reflected from the mirror, except when the latter is purposely obscured. The appearance and disappearance of the bright spot or flash constitute the signals. There is no need for any superintendence when once the apparatus has been put in working order, and a trained signalman suffices for the duty. The ordinary Morse alphabet supplies an intelligible code, and no one out of the line of signals can read or understand the message. As a substitute for the dot and dash, which go to make up the ordinary written Morse code, the light is shown for short and long intervals; thus the light shown for a short period followed by a long period signifies A, while B is represented by a long period followed by three short ones; in the case of C, long, short, long, short signals are made in turn, and to form E (the letter most frequently used), the light is permitted to shine for one single short period only. The intensity of these sunshine signals can scarcely be imagined by any one who has not seen the heliostat in working order, and the distance to which they might be made to travel, could suitable stations be provided, is practically unlimited. The appearance or non-appearance of the light can be noticed at ten or twenty miles distance without the aid of telescope or field glass.

Postal Zoological Garden.

German post offices are zoological gardens on a small scale. According to the *Tribune*, in the course of a year as many as 40,000 live animals are sent by post, and if crabs, frogs, bees, and small insects are counted, the total will be among the millions. The post office authorities have the privilege of excluding such animals as may be deemed either dangerous or disagreeable; but within the last six months, only 39 packages of living animals were refused, among which were an alligator, done up in a box considered as too fragile; a lot of dogs, whose persistent barking could not be quieted; and a number of pigeons loosely tied up in a sack. On the other hand, during the same period, a crocodile, scores of birds of prey, monkeys, serpents, a leopard, and four living bear cubs were transmitted by post.

PROFESSOR PANCOAST has been exhibiting and explaining the Carolina twins to the students of the Jefferson Medical College, Philadelphia. They are the pair who have been widely shown as a two-headed girl. The professor considers them far more wonderful than the Siamese twins, who were two distinct persons, while these negro sisters have a single back bone below the shoulder blades, at which point the spinal column branches like the arms of a letter Y. They were back to back at birth, but in learning to walk they twisted themselves to facilitate locomotion, and now stand nearly side by side. Experiments showed that when either was touched below the point of union both felt it, but above that point there was a separate sensitiveness. Dr. Pancoast thinks they will die simultaneously.

THE WINDOW GARDEN.

Nothing adds more to the cheerful appearance of the interior of a house than an array of choice plants, but too frequently it happens that the hideous red pots containing them are permitted to stand out in bold relief, entirely neutralizing the pleasurable effect of the plants. Our engraving shows a beautiful plant stand, or window garden, which may receive the earth in which the plants are rooted, or the pots may be placed in it and hidden by it. The fish in the globe at the top give it life, and the whole forms a beautiful ornament for the window.

THE WINDOW GARDEN.

THE YAK.

The yak, or grunting ox, derives its name from its very peculiar voice, which sounds much like the grunt of a pig. It is a native of the mountains of Thibet, and according to Hodson, it inhabits all the loftiest plateaus of High Asia, between the Altai and the Hamalayas.

It is capable of domestication, and is liable to extensive permanent varieties, which have probably been occasioned by the climate in which it lives and the work to which it has been put. The noble yak, for example, is a large, handsome animal, holding its head proudly erect, having a large hump, extremely long hair, and a very bushy tail. It is a shy and withal capricious animal, too much disposed to kick with the hind feet and to make threatening demonstrations with the horns, as if it intended to impale the rider. The heavy fringes of hair that decorate the sides of the yak do not make their appearance until the animal has attained three months of age, the calves being covered with rough curling hair, not unlike that of a black Newfoundland dog. The beautiful white bushy tail of the yak is in great request for various ornamental purposes, and forms quite an important article of commerce. Dyed red, it is formed into those curious tufts that decorate the caps of the Chinese, and when properly mounted in a silver handle, it is used as a fly flapper in India under the name of a chowrie. These tails are carried before certain officers of state, their number indicating his rank.

The plow yak is altogether a more plebeian-looking animal, humble of deportment, carrying its head low, and almost devoid of the magnificent tufts of long silken hairs that fringe the sides of its more aristocratic relation. Their legs are very short in proportion to their bodies, and they are generally tailless, that member having been cut off and sold by their avaricious owner. There is also another variety which is termed the Ghainorik. The color of this animal is black, the back and tail being often white. The natives of the country where the yak lives are in the habit of crossing it with the common domestic cattle and obtaining a mixed breed. When overloaded, the yak is accustomed to vent its displeasure by its loud, monotonic, melancholy grunting, which has been known to affect the nerves of unpracticed riders to such an extent that they dismounted, after suffering half an hour's infliction of this most lugubrious chant, and performed the remainder of their journey on foot.

William Kingdon Clifford.

The scientific world has recently sustained another heavy loss in the death of Prof. William K. Clifford, which occurred at Madeira on the 4th of March. Prof. Clifford, one of the deepest thinkers and most brilliant writers of the present century, was the eldest son of the late Mr. William Clifford, an Alderman of Exeter, England, and was born on the 4th of May, 1845.

He received his earlier education at the school of Mr. Templeton in his native city, and from thence proceeded to King's College, London. Here he gave evidence of his great intellectual powers by shortly obtaining high honors, taking in his first year, 1861, the Junior Mathematical and Junior Classical Scholarships and the Divinity Prize. In the two succeedings years he gained the Classical and Mathematical

THE YAK.

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Scholarships of the year, and in addition to the Inglis Scholarship for English language, an extra prize for the English essay.

Shortly after taking his degree he was elected a fellow of his college, and filled the post of assistant tutor until his election to the chair of Applied Mathematics and Mechanics at University College, London, in August, 1871, a position which he held until his death. He was elected a Fellow of the Royal Society, June, 1874.

Prof. Clifford was distinguished not only for his rare talent for mathematics, but for a remarkable capacity for bringing the most advanced scientific ideas within the range of ordinary knowledge. His "Analogues of Pascal's Theorem" was written while he was still in his eighteenth year, and constitutes the first of his papers recorded in the Royal Society's catalogue. "Analytical Metrics," one of his longest and most fully worked out papers, published in the *Quarterly Journal of Mathematics*, was written in his nineteenth year. At the Royal Institution, on March 6, 1867, he addressed a large public audience for the first time, the subject of his lecture being "Some of the Conditions of Mental Development." Among his auditors on this occasion were some of the leading thinkers of the time, and from that day he took a recognized place among them. His remarkable power of explaining some of the most difficult physical conceptions to a popular audience was well exhibited at a subsequent date, on the occasion of a delivery, at St. George's Hall, of a series of lectures on subjects such as "Ether," "Atoms," and "The Sun's Place in the Universe."

The position taken up by Prof. Clifford in philosophy was never comprehensively defined by himself, but must be collected from his numerous papers and lectures of the last few years. In pure metaphysics may be specified articles on "Body and Mind" (*Fortnightly Review*, 1875), and the "Nature of Things-in-Themselves" (*Mind*, 1878); in ethics, "The Scientific Basis of Morals" (*Contemporary Review*, 1875), "Right and Wrong" (*Fortnightly Review*, 1876); and in the application of ethical theory to social and religious questions, "The Ethics of Belief" (*Contemporary Review*, 1876), "The Bearing of Morals on Religion" (*Fortnightly Review*, 1877), and an article on Virchow's address on the freedom of science (*Nineteenth Century*, 1878).

He was unmistakably one of the foremost English mathematicians of our day, and had he lived would have done much more to maintain that position; but a constitution naturally weak gave way to too close attention to his favorite studies, and the dread disease, consumption, cut short a brief but brilliant life.

ARTIFICIAL LIGHTING FOR PHOTOGRAPHY.

The subject of artificial lighting in the portrait studio is attracting much interest in England.

Three methods are employed for producing a highly actinic light suitable for the purposes of the photographer—the electric, the pyrotechnic, and that produced by the combustion of magnesium wire. Each of these lights has its special disadvantages, and for each the excellence of the results depends far more upon the arrangements for using the light than upon the light itself. And the arrangements which answer best with one light are apt to be wholly unsuited for use with any other light.

The great difficulty with electric light, next to its excessive cost, is to secure a sufficient diffusion of the rays, and to subdue their intense brilliancy without too great a loss of actinic power. A method of burning pyrotechnic compound in a paper case, whereby a larger illuminating surface is produced, gives, it is said, much better results. In the electric light the rays proceed from a point, diverge rapidly, and as rapidly lose illuminating power. Thus an electric light with six minutes' exposure failed to give anything but the most brightly lighted points of the picture, when the same light, used with an imperfect reflector, gave a better result in two minutes. With the pyrotechnic compound burned in case, or, better, in a saucer, the rays proceed from a surface of considerable extent, and are less divergent; hence at a given distance from the light the loss is much less than with the electric light. When the latter is used with a translucent screen covering the front of the reflector it shows an intensely brilliant center, surrounded by a circle less brilliant and curiously variegated by a network pattern caused by reflections; while the space between it and the center appeared quite dark in comparison. With the pyrotechnic light the screen is evenly illuminated, and no light is lost.

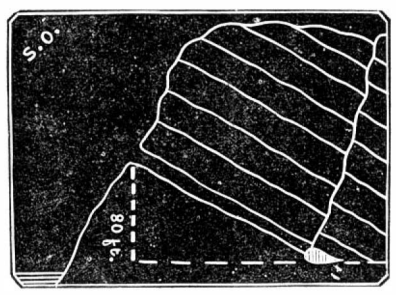
When used with an apparatus called the luxograph the results obtained are said to be very fine. The luxograph is described as a slightly conical metal cylinder resembling a kettledrum, nearly six feet across. The drumhead, so to speak, is made of a peculiar paper charged with a mineral which increases the dispersing power of the screen. The interior of the cone, or drum, is lined throughout with small mirrors, making it a powerful reflector. In the center of the back is a square lantern of blue glass, of three different tints, open at the top. The pyrotechnic powder is burned in the lantern. When the combustion has reached its height the sitter's face is flooded with a soft violet light of the most diffusive and actinic character. The fumes of the pyrotechnic compound and the brevity of the combustion are its chief disadvantages.

The best magnesium light is said to be produced by the lamp made by Mr. A. Brothers, of Manchester. It consists of an arrangement by which three ribbons of magnesium are burned at once, and the light thrown upon the sitter by parabolic reflectors. The great objection to it is the cost of operating it. In a communication to the Edinburgh Photographic Society, Mr. Thomas W. Drinkwater expresses the conviction that the method of the future will employ coal gas. As gas is ordinarily burned, the light lacks both power and actinity; but when the gas has been fortified by the addition of hydrocarbons, or, more especially, when the much lauded Sugg burner is used, an extremely brilliant, cheap, and easily managed light for photographic purposes is said to be attainable. To this process, however, the crucial test of practical use does not appear to have been applied.

In England, with its dull and foggy climate, not to speak of the chronic sunlessness of London, the question of artificial illumination for portraiture is of real and practical moment. It our sunny climate it partakes more of the character of an advertising novelty. Nevertheless it may not prove an unprofitable field for experimental work even here.

Formation of Ice Caves.

In the SCIENTIFIC AMERICAN for March 29 last, there appeared a letter from Mansfield, Ohio, inquiring as to the cause of the phenomena in an ice cave which is to be found in Decorah, Iowa, and for which there appears to have been, as yet, no cause assigned. A description of this cave is given in the same letter, of which description, so nearly as is possible, the accompanying illustration is a fair representation, as regards the main features of the case. There may be a few differences as regards the details of the cave, but so nearly as can be judged from the written description, the drawing presents the elements necessary to the peculiarities of the cave. In the figure, the cave will be seen represented as at the bottom of an inclined passage, the inclination being



that noted in the description, and the dimensions and other particulars being as nearly as possible to the proper scale. The crevice, mentioned in the description, may be imagined as a fault, which extends from the top of the cave to the top of the bluff, through which crevice mingled air and water find their way to the cave.

In regard to the mingling of air with a stream of descending water, a quotation from the pamphlet of Mr. Frizzel, on the subject of the compression of air by such streams, would not be entirely out of order. On this subject, he says:

"It is a matter of common observation that bubbles of air rise in still water with a very moderate velocity. The velocity depends, somewhat, on the size of the bubbles. Bubbles, such as issue from an orifice one eighth or one tenth of an inch in diameter, rise from a depth of fifty feet in about fifty seconds, moving rather less than one foot per second near the bottom, and rather more than that near the surface. It is plain that a bubble of air drawn into water that has a downward motion of more than one foot per second, will be carried down and subjected, in its descent, to a continually increasing pressure."

Considering, then, the description and the facts above quoted, it would not be unfair to assume that there would be a possible compression of air contained in the water, on its liberation in the cave, of about eighty pounds to the square inch. This assumption is supported by the fact that from the description, the mouth of the cave would be at least eighty feet above the level of the river, and it may be inferred that as no special mention is made on the position of the entrance, save that it is in the side of the bluff, the hill may be considered as extending above the mouth of the cave to at least the distance of the latter from the river.

The phenomenon, then, of ice being found there in the summer, can be referred, I think, to the theory of the liberation of compressed air brought down from a considerable height by a stream of water falling or flowing through a natural conduit or fissure in the rock, embodying the principle of the ancient and well known tromp used in the Catalan forge, and still in use in Corsica, Sardinia, Savoy, and many other places.

It is only necessary to imagine such imperfection in the conduit or fissure at the initial point, which is supposed to be on the top of the bluff, or far up the mountain's side, as would admit air to come in contact with the water after it had attained a velocity of more than one foot a second. When the air has reached the bottom and is liberated in the cave, it will be from a pressure equal to the height of the column of water, and it will have lost by convection in the mass through which the conduit passes, the heat due to its compression; and on being liberated, it will immediately absorb from the air and the water in the cave, the heat which it has lost in its downward passage.

"The most remarkable fact," that the cave freezes only in summer, and as the cold of actual winter comes on, the ice in the cave gradually melts and disappears, is caused, I will venture to state as an opinion, by the gradual freezing of the surface at the top of the bluff or the source of the air, to a considerable depth, thus sealing up the aperture through which the air entered the conduit.

Sir Roderick Murchison described a similar ice cave at Lletski, Russia, but gave no explanation as to the phenomena.

Ice wells are to be found at the foot of Mount Mansfield, in Vermont, and are really incipient caves, without depth enough to be clear of ice in winter, from the fact that the external winter temperature reaches the bottom or source of the summer ice.—*N. M. Lowe, in Science Observer.*

Correspondence.

The Brush Electric Light.

To the Editor of the Scientific American:

In notes on "Electric Lighting," March 1, you mention the fact that the makers of the Brush machine claim to be able to produce 17 or 18 lights from one machine with an expenditure of 13 to 14 horse power, adding: "This statement, however, should be accompanied by accurate tests, which do not appear to have been made." We desire to correct the impression conveyed by referring to the actual performance of several machines sold by us and in regular industrial use to-day. One of these is at the Merrimack Mill, Lowell, Mass.; one at the Conant Thread Company, Pawtucket, R. I.; two at the Riverside Mill, Providence, R. I.; two at the immense retail establishment of John Wanamaker, Philadelphia, Pa.

All of these machines are of same size and power, and the average of over twenty tests of power absorbed by them, taken with a dynamometer, was $13\frac{85}{100}$ horse power. Each machine furnishes 16 to 17 lights, each of 2,000 candle power, and all the lamps are placed in series on one circuit.

We are not aware that any other system of electric lighting known or described to-day can produce the result above shown. It certainly very far exceeds in economy and efficiency the Gramme-Jablochkoff system in use in Paris and London, and we do not see that Rapieff, Werdermann, Lontin, De Meritens, or any others, have actually done as much as they have.

We have just closed a contract for the lighting of Monument Park, in this city, with the Brush electric light. We displace 105 gas lamps, six-foot burners, with 12 Brush lights, and the cost to the city is considerably less than has been paid for the gas lamps, and we shall furnish not less than double the light they did.

We advertise regularly in no paper but the SCIENTIFIC AMERICAN, and have not endeavored to create a "newspaper furor" regarding our light—*à la* Edison, Sawyer, *et al.;* yet we have sold for actual industrial use in this country, within one year, over 200 Brush lights, and we are running our factory night and day on orders for similar purposes.

Regarding the use of electric light in dwellings, or on a small scale, we all agree with Mr. Brush, that there is as yet nothing before the public, here or abroad, which promises success in this direction.

Mr. Brush is aiming simply to produce the greatest possible number of powerful steady lights from one machine in one circuit with the least expenditure of power. Have you any record of results equal to his? G. W. STOCKLY,

Vice-President Telegraph Supply Company,
Cleveland, Ohio.

A CHANCE FOR INVENTORS.

The Secretary of the Treasury has constituted a board, consisting of Captain Forbes, manager of the Massachusetts Humane Society; Captain Moore and Lieut. Sparrow, of the Revenue Marine Service; together with Mr. B. C. Sparrow and Captain Patterson, of the Life Saving Service, to investigate all plans, devices, and inventions for the improvement of apparatus for use at life saving stations, which may appear meritorious and available, and to examine and test as far as practicable all such as may be submitted by the general superintendent, and to make detailed reports of the results of the investigations and tests for his information. The scope of the board embraces action upon all devices for the improvement of life saving apparatus intended to be used at the life saving stations, except wreck ordnance and its immediate appurtenances, which will be referred to a board composed of experts in gunnery, and two practical surfmen to give them aid upon points connected with the actual wreck service. Devices intended to be carried on board ship do not fall within the scope of the action of the board, as this class of life saving apparatus is taken cognizance of by the steamboat inspector's service. Capt. Forbes has been designated president, and has been directed to call a meeting of the board as early as practicable, as there are already on hand several inventions to be examined. Persons wishing to have their inventions submitted to the board may address Mr. S. I. Kimball, Superintendent of the Life-Saving Service, at Washington, D. C.

Beatty Organs and Pianos.

When a manufacturer is willing to send expensive wares to a distance at his own risk for trial, and to pay freightage both ways in case of rejection, it is evident that he has no lack of confidence in the intrinsic merit of what he has to sell. When he finds the practice a profitable one, the evidence is quite as strong that the articles offered are worthy of their maker's confidence in them, and that their rejection is not apt to occur.

The offer made in our advertising columns by Mr. D. P. Beatty, organ and piano manufacturer, Washington, N. J., tells its own story. Within a few years Mr. Beatty has built up a large and successful business; and by dealing directly with the users of his pianos and organs, avoiding agents' fees and profits, he is able to furnish superior articles at extremely low rates.

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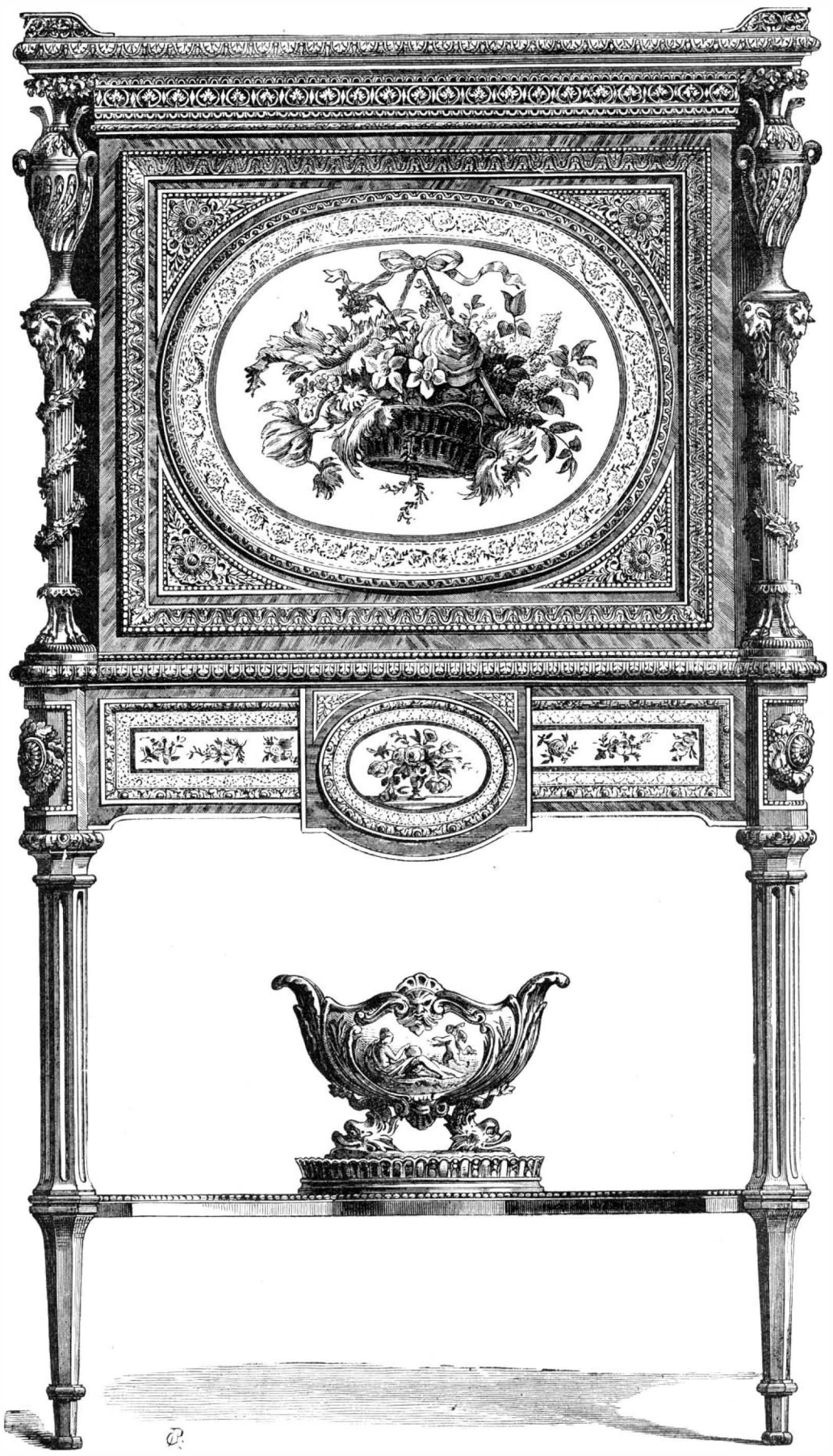
AN ELEGANT CABINET.

When, under the reign of Louis XVI. (towards 1780), the true principles of art began to prevail again, the degenerated and capricious forms of the preceding epoch, under the Régence and Louis XV., disappeared gradually to make room for straight forms of a purer character, suggested by the revival of classical art. Nowhere more than in cabinet work and furniture do we remark this new tendency: classical entablatures replace the contorted forms of the Rococo; caryatides, acanthus leaves, and enriched mouldings in ormolu, plaques of porcelain, painted with pastoral scenes and flowers, cameo medallions in porcelain and glass, are introduced instead of the confused scroll work and unmeaning decoration of the style of Louis XV. The artistic treatment, although somewhat dry and stiff, contrasts agreeably with the unconstructive and degenerated forms of the preceding period; its deficiencies are partly due to the application of cast metal ornament, which replaced almost entirely the carving in wood, partly to the taste and fashion of the time.

The piece of furniture represented here belongs to this style of art, and shows rich ornaments in bronze gilt and inlaid plaques of Sèvres porcelain, *pate tendre*, with bouquets of flowers.*



CABINET IN THE ROYAL PALACE IN MADRID.

Marine Silk.

Among the many novelties which industry obtains from the sea, one of the most curious is the textile product made with the "byssus" of the *Pinnas* of the Mediterranean—the "fin shells" or "sea-wings," as they are called. The species are the *Pinna nobilis, P. rugosa*, etc.

The shells, which are usually very fragile, resemble in form those of the larger species of muscles, being long and tapering, narrow at the back, and gradually expanding to a considerable breadth toward the opposite extremity. There are some twenty or more species of the genus, which produce in large quantities a very fine sort of silky byssus or braid. It is called by the fishermen *lana pinna*, or fish wool. These bivalves are provided with a tuft of delicate fiber, which cannot be better compared than to fine hair or silk, or spun glass; with this they attach themselves to the rocks, living continually under water. The ancients made this material an article of commerce, greatly sought after, and the robes made from it, called "tarentine," were held in great esteem. It is said that the scarf of the turban of Archytas was made of this fiber. In the year 1754, a pair of stockings, made of it, were presented to Pope Benedict XV., which, from their extreme fineness, were inclosed in a small box about the size of one for holding snuff. A robe of this material is mentioned by Procopius as the gift of a Roman Emperor to the satrap of Armenia.

Even in the present day the fiber is utilized, but more for its rarity than anything else. The women comb the *lana* with very delicate cards, spin it, and make from it articles which are much esteemed for the suppleness of the fiber, and its brilliant burning gold luster. In Italy the poorer girls and women make from it purses, necklaces, ear rings, etc., and it thus proves a no mean source of income to hundreds of families. A considerable manufactory is established at Palermo; the fabrics made are extremely elegant, and vie in appearance with the finest silk. The best products of this material, however, are said to be made in the Orphan Hospital of St. Philomel, at Lucca.

At both the London and Paris Exhibitions there were shown shawls, stockings, gloves, etc., made of the material. This byssus forms an important article of commerce among the Sicilians, for which purpose large numbers of the *Pinnas* are annually fished up in the Mediterranean, by means of an instrument called a "cramp." This is a kind of iron fork with long, perpendicular prongs, about six inches apart. Notwithstanding the extreme delicacy of the individual threads, they form such a compact tuft that considerable strength is necessary in separating the shells from the rocks to which they are attached. The tuft of silk is broken off and sold to the country women, who wash it in soap and water. They then dry it in the shade, straighten it with a large comb, cut off the useless root part of it, by which it adhered to the animal, and card the remainder. By these means a pound of coarse filaments is reduced to about three ounces of fine useful threads. This is fabricated into various articles for the person, such as shawls, stockings, caps, waistcoats, gloves, etc. The web is of a beautiful yellow brown, resembling the burnished golden hue which adorns the backs of some splendid tropical flies and beetles.

* *The Workshop*, Willmer & Rogers News Co. Agents, 31 Beekman street, New York city.

A Large Orange Tree.

The *Florida Agriculturist* describes, as the biggest orange tree in that State, one at Fort Harley, near Waldo. Its height is 37 feet, circumference at top 81 feet, circumference of trunk just above ground 8 feet 5 inches. At a foot from the ground it branches into four trunks, measuring respectively 37½, 39½, 40¾, and 43 inches in circumference. Each of these fork from three to five feet above ground, and again higher up. All are bare of small limbs and foliage for many feet up, except on the outer sides, so that the interior of the tree presents the appearance of a huge umbrella.

THE CATALPA AS A TIMBER TREE.

Nearly a year ago (July 22, 1878), the SCIENTIFIC AMERICAN noticed at great length the claims made by Mr. E. E. Barney, of Dayton, Ohio, in behalf of the catalpa as a tree worthy of general cultivation.

Mr. Barney has now published a second pamphlet, giving additional facts and information with regard to this useful tree, from which we are glad to learn that his efforts have been well rewarded. From every State and Territory in the Union many letters of inquiry have been received by him, and some also from England, South Australia, and New Zealand. What is better, quite a number of gentlemen—notably, Suel Foster, of Muscatine, Iowa; J. F. Tallent, Burlington, Iowa; and Horace J. Smith, Georges Hill, Philadelphia—have generously engaged in the work of distributing catalpa seeds, especially in the West; and the indications are that the planting of the coming season will result in some millions of trees. The growth of the catalpa is exceedingly rapid, particularly in the rich soil of the prairies.

During the autumn of 1877, the Missouri River, Fort Scott and Gulf Railroad, commenced experimental plantations of various trees on their land, near Fort Scott, in Kansas. The superintendent of the road, in his report to the president on the condition of these plantations at the end of their first year, says: "The catalpa has certainly proved to be the strongest grower, and most tenacious, standing the dry weather better than other varieties, and at present rate will come to maturity years before other varieties are of sufficient size to be of any utility." Last fall 100,000 catalpas were planted by this road. Mr. Barney says:

"I have urged the cultivation of catalpa, believing it will give the largest return in the shortest time. Its economic uses are more varied and extensive than any one tree with which I am acquainted.

"If I had a grove of common catalpa that would not be affected by the frost, I should certainly let them grow. If I wished to plant a grove of catalpa, above or below the frost line, I would most certainly plant only the Speciosa variety, as clearly better adapted to forest culture.

"I by no means ignore the fact that there are other valuable trees for forest culture—notably the white walnut or butternut, black walnut, yellow locust, red and black mulberry, Osage orange, ailanthus, cherry, ash, oak, and many others, of the respective merits of which I leave others to speak.

"At the time I printed my first pamphlet I was under the impression that the examples of durability given were mostly, if not wholly, common catalpa. As it became more and more apparent, on further investigation, that the Speciosa variety was much preferable for forest planting, I felt it to be of the greatest importance to know, beyond any question, that this variety was equally durable."

The investigations made at Mr. Barney's instigation prove beyond a doubt that the Speciosa catalpa possesses the wonderful durability for which the catalpa is noted. The evidence is given at length in the pamphlet, which Mr. Barney will be glad to send to any inquirer for six cents, to cover the cost of printing and postage.

FEATHERS IN TEXTILES.—According to the Paris *Figaro*, the shops will soon have the new textiles in feathers and wool and cotton on sale. This is an invention of M. Bourguignon, of Donchery, who has found how to weave feathers (deprived of the horny substance) and incorporate them with woolen and cotton yarns in proportions varying from 10 to 75 per cent. Some very fine textiles are thus made, and especially a flannel which for warmth and lightness is unapproachable.

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AN INTERNATIONAL EXHIBITION OF INDUSTRIAL SCIENCE.

An International Exhibition of the Sciences applied to Industry will be held in the Palais de l'Industrie, Paris, from July 24 till November 25, 1879.

The President of the Superior Committee is M. Cocherie, Under Secretary of State at the Ministry of Finance; the Secretary-General, M. De la Bruyère, Administrateur de la Caisse d'Epargne de Paris; and the Director, M. P. Nicole, Administrateur Général de l'Union Syndicate de Paris, who organized the Havre Exhibition in 1867, and the Exposition Maritime et Fluviale in 1875.

The scope of the Exhibition can best be appreciated from a summary of its programme, for which we are indebted to Messrs. Emile Caspar & Co., sole agents for the United States and Canada, 73 Great Tower St., London, E. C. The programme comprises 9 groups, with 69 classes, as follows:

GROUP I. relates to *Prehistoric Knowledge, Anthropology, and Education.*—Class 1 embraces ethnographical collections, illustrating the life of primitive man and modern savages, with specimens of prehistoric habitations, while, by way of contrast, Class 2 will contain specimens of various industries at the present day, showing the life of civilized beings in different countries. Class 3 is devoted to ecclesiastical art, and Class 4 to education and instruction, comprising schools for the deaf and dumb and blind; trade—commercial and agricultural—schools; the higher education, and apparatus and methods of instruction.

GROUP II.—*Applied Physics.*—Class 5 includes all the more recent applications of electricity, and the electric light; Class 6, the electric telegraph, with the various transmitting and receiving instruments, and the working of the telephone on telegraphic wires; Class 7, processes and specimens of electro-metallurgy; Class 8, optical instruments for both science and industry; Class 9, photography, including its new applications, and other methods of utilizing light; Class 10 (the production of heat and cold) embraces the utilization of solar and terrestrial heat, machines for making artificial ice, and for the liquefaction of gases, as well as instruments for measuring degrees of heat and cold; Class 11 (warming, lighting, and ventilation) includes fireplaces, stoves, apparatus for the use of mineral oil for domestic and industrial purposes, artificial gas and electrical illumination; Class 12 relates to hydrostatics, hydraulics, and pneumatics; and Class 13, to the production and utilization of sound, acoustic telegraph, the telephone, aerophone, and phonograph.

GROUP III.—*Applied Chemistry.*—Class 14. The manufacture of artificial products. Class 15. Bleaching, dyeing, and printing stuffs. Class 16. Chemical apparatus and cases of testing materials. Class 17. Chemical processes in glass manufacture, and specimens of various glass work. Class 18. Processes of raw materials employed in porcelain manufacture, with specimens of the various products. Class 19. Perfumery. Class 20. Pharmaceutical and hygienic chemistry. Class 21. Wall paper and imitation leather. Class 22. Leather and hides, with their applications. Class 23. Appliances and products of the India-rubber and gutta-percha trade. Class 24. Preserved foods, and apparatus for their preparation.

GROUP IV.—*Applied Mechanics.*—Class 25. Mechanics applied to the liberal arts, printing and lithographic presses, voting and writing machines. Class 26. Mechanics applied to furniture and musical instruments. Class 27. Machines and tools used in Morocco leather manufacture, marquetry, and toy making. Class 28. Goldsmith's work and clock making. Class 29. Weaving. Class 30. Manufacture of shoes and hats. Class 31. Making nets and other appliances for fishing. Class 33 includes agricultural implements, machines, and appliances for the preparation of food. Class 34 is restricted to mining and metallurgical plant, including steam engines, models of underground workings, appliances for the driving of tunnels, foundations by means of compressed air, furnace bars with water circulation, metals, alloys, and specimens. Class 35 embraces the plant of chemical works, paper mills, and dye works, new motors, utilization of the force of the tides, removing incrustation from steam boilers, etc.; and Class 36, the manufacture of arms and projectiles.

GROUP V.—*Mechanics Applied to Locomotion.*—In Class 37 will be represented railway plant, permanent way, and their maintenance, steep gradient lines; improvements in railway carriages, their lighting and heating; steam tram cars, locomotives working with compressed air, and traction engines; new brakes; underground lines and tunnels; and in Class 38 vehicles of different kinds employed by various nations, and velocipedes. Class 39 is devoted to navigation, and Class 40 to aeronautics; Class 41 to traveling appliances, including portable apparatus for scientific expeditions; and Class 42 to articles and products employed in the packing of goods, and lifting machinery.

GROUP VI.—*Applications of Natural Science* (Class 43) *to Agriculture and Horticulture, and* (Class 44) *to Forestry.*—Class 45 relates to the various natural products employed in industry; Class 46 to the utilization of textile fibers, basket work, straw paper, and cardboard; Class 47 to artificial flowers, fruits, and shrubs; Class 48 to natural history, with appliances for the taxidermist; Class 49 to useful and injurious insects, with methods for the destruction of the phylloxera. In Class 50 will be found specimens of alimentary substances. Class 51 relates to pisciculture; Class 52 to fisheries; Class 53 to non-alimentary sea produce; Class 54 to medical science and instruments, and the acclimatization of cinchona and the eucalyptus in Africa and the South of France; Class 55 to surgical science and instruments; and Class 56 to dentistry. Class 57 covers the wide field of sanitary science, individual and general, comprising discoveries relating to hygiene and the well being of the working classes, baths, gymnasiums; public and private closets, the purification and utilization of water, sluices, and sewers; appliances connected with highways and systems of paving; fire engines and fire signals; waterworks and mains; matters relating to hospitals and models; and, finally, appliances for cremation.

GROUP VII.—*Mathematical Instruments* for (Class 58) measuring, dividing, and calculation; (Class 59 astronomy and navigation, including balances, weights, and measures; (Class 60) astronomy; (Class 61) meteorology, and (Class 62) horology, including astronomical clocks and chronometers, public clocks and their illumination, pedometers, etc.

GROUP VIII.—*Geology* (Class 63) applied to agriculture and (Class 64) industry; artificial stone and raw products for ceramic art, with specimens. Class 65 includes mineral fuels and exploring plant, works for obtaining a water supply, artesian wells. Class 66. Precious stones. Class 67. Geological and palæontological collections, plans, and sections.

GROUP IX.—In Class 68 will be found books, manuscripts, and designs relating to the classes of the Exhibition; while Class 69 will consist of replies to a series of questions, addressed to each exhibitor, either introduced or under consideration.

GROUP X.—*Special Exhibit of the Direction of the Exhibition of Sciences Applied to Chemistry.*—A. Reproduction of a glacier (about 10 meters high), with an internal grotto, wherein will be figured the different terrestrial formations, and the fossils met with in each of them. B. Reproduction on a large scale of a prehistoric habitation, a habitation of modern savages, and a model house of the present day, in which hygiene, comfort, and luxury have been attended to. C. A map in relief of Europe at the tertiary epoch. D. A grand dioramic view of the spot where Paris now stands, before the apparition of man on earth. E. Grand dioramic view of the same spot during the cave period.

GROUP XI. embraces a loan collection of artistic and industrial objects, and also temporary exhibitions of flowers, fruits, and vegetables.

The aim of the directors of this exhibition is to make it excel not in bulk, but in the careful selection and educational value of the objects and processes exhibited. The charge for exhibition space is low, and no charge will be made to workingmen, scientific societies, museums, governments, and exhibitors generally, whose productions are of an exceptionally interesting character.

RECENT AMERICAN PATENTS.

An improved mill for removing the germ and the fuzz from the kernels of wheat, without reducing the wheat or making flour, has been patented by Messrs. Samuel Potts and Orvid Parson, of Somerset, Wis. It is said that the flour made from wheat prepared by this mill is of superior quality.

An improved combined pocket match safe and candle holder has been patented by Mr. Francis A. Farrell, of Brooklyn, N. Y. It is compact and convenient, and may be readily carried in the pocket.

An improved discharge pipe plug for wash basins, patented by Mr. John S. Gilbert, of New York city, is so arranged that it cannot be removed from its wash basin, and will close automatically when released.

A new pad for securing an extra pad or housing to a harness saddle, which holds the pad securely, preventing it from sliding, drawing, and twisting, has been patented by Mr. Turner Buswell, of Solon, Me.

An improved cartridge, having a shell capable of taking a number of balls each, supplied with a separate charge of powder, and arranged so that the foremost charge will explode first and the others in succession, has been patented by Mr. John E. Tyler, of Roxobel, N. C.

Mr. Ira L. Sherman, of Cattaraugus, N. Y., has patented an improved iron fence, having an ornamental two-part rail which clamps the pickets on opposite sides, and is held together by sleeves which slip over the two parts.

Mr. George Lizars, of Paris, France, has devised an improved wet gas meter, provided with a compensating measuring drum, by which a uniform amount of gas is passed through the meter without regard to the level of the water.

An improved gag runner for harness has been patented by Mr. William M. Blain, of Salinas, Cal. It is adapted to receive a rosette loop for attachment to the bridle, and it forms a neat and simple attachment to the bridle for guiding the reins.

A novel and simple device for holding and displaying sample shoes on shoe boxes, has been patented by Mr. Benton Elliott, of Ellsworth, Wis. It consists of a spring clasp made from sheet metal, and it may be readily applied to the shoe and the box.

The Odor of Human Hair.

In *Le Progrès Medical* M. Galippe calls attention to the medico-legal value of the odor of the human hair. He asserts that from the simple smell of a lock of hair he can tell whether the lock has been cut from the living subject or whether it has been composed of hair that has fallen out. Hair dressers have acquired this art, which is said never to fail them. Hair which has fallen out has a dull appearance, attributable to disease, and is not easily made up; it has no peculiar smell. The hair of the Chinese has a characteristic odor of musk, which is so persistent that it cannot be concealed by cosmetics, for it cannot be destroyed by washing with potash. The hair of the Chinese has also a reddish tinge, and is polyhedral in section. Hair of hysterical patients has a peculiar and distinguishing odor which is most perceptible at the approach of a crisis. Certain hair is electrical, the electricity being developed more readily after rubbing. M. Bert states that hair which is turned white from age begins to change color rather at the apex than at the base.

The Cultivation of Vanilla Beans.

It is probable that the plant which produces the vanilla bean will soon be grown to a larger extent than hitherto. At present the main supply of the bean comes from Mauritius, Brazil, and Mexico, but there is every reason to believe that the parasitical plant which produces the bean can be raised with profit in many other places having the necessary climatic conditions and trees which will afford it the requisite shade. The vanilla plant grows to the height of about a foot, thrives for 30 or 40 years, and produces about fifty pods each year after the second year. The beans require eight or nine months to mature. To prevent them from excessive shrinking they are oiled occasionally, and then are dried in the sun. When warm they are wrapped in woolen cloths to absorb the evaporation, and at this stage they acquire their fine silvery black color.

A Remedy for Whooping Cough.

Dr. Garth (*Wiener Allgem.*) states that by placing xx. gtt. ol. terebinth. on a handkerchief, holding it before the face, and taking about forty deep inspirations, to be repeated thrice daily, signal and marked relief, followed by rapid cure in cases of laryngeal catarrh, is the result. In an infant fifteen months old, in the convulsive stage of whooping cough, he directed the mother to hold a cloth, moistened as above, before it when awake, and to drop the oil upon its pillow when asleep. The result was markedly beneficial. In twenty-four hours the frequency and severity of the attacks were notably diminished, and by proper support by aid of stimulants, the improvement was rapid. Subsequently pertussis became epidemic in his vicinity, and he repeatedly used the drug in this way. He gave it to children of all ages, and in any stage of fever. The initial catarrh, the convulsive, and the final catarrhal stages were all decidedly benefited, the spasmodic attacks being in many cases aborted.

Heat Without Fuel.

Mr. M. A. Shepard, of Lebanon, Ill., has patented a method of utilizing the uniform temperature of the earth at a distance beneath the surface for the purpose of warming the air supplied to dwellings in winter and cooling it in summer. From a two column article in the Lebanon *Journal*, headed a "Wonderful Scientific Discovery," we take the following description of the leading features of his invention:

This new improvement is simply to sink a well or shaft into the earth till a living spring or stream of water is reached, which is invariably at the same temperature as the earth. At the bottom of this excavation is a series of coiled iron pipes (or they may be arranged similar to steam radiating pipes), placed down into the living water. At one end a connection is made to a large pipe extending to the surface of the earth, through which air is admitted to the series of pipes in the living water. At the other end a large pipe is connected, and arranged to communicate with the buildings to be supplied with air. All that now remains necessary to produce the uniform temperature of the water in the earth is to force or draw the air through these pipes and bring it into the buildings. This will require but a small amount of power.

The title of this new improvement and discovery is a new method of producing heat and ventilation. Patented March 11, 1879.

Strange Freak of Water Fowl.

For several mornings past the guards at the government bridge over the Mississippi River at this point, with other citizens whom they have informed of the occurrences, have been greatly interested in the actions of wild water fowl—ducks and geese, and even swans. About midnight these fowl commence gathering in the river, probably a mile above the bridge, and float down to the bridge, attracted, no doubt, by its lights. The moment they strike its shadow, as made by the lamps, they leave the water, fly up stream some distance, again float down to the bridge, and again rise and return, to repeat the trip. The bridge guards and tenders believe that these flocks often number 300 to 500 ducks and geese. Saturday morning four swans were seen with one flock. When they rise from the water they go up with a rush and whirr that can be heard three or four blocks distant. When the gray of dawn appears in the east the bridge men can see fowl leaving the water up stream as far as vision can reach—and off they fly for the north. The sloughs near to and the small streams which empty into the Mississippi were frozen during the recent cold snap, and the great river is the only open water the birds can find. But it is strange they do not alight in the water below the bridge as well as above it.—*Davenport (Iowa) Gazette.*

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TO INVENTORS.

An experience of more than thirty years, and the preparation of not less than one hundred thousand applications for patents at home and abroad, enable us to understand the laws and practice on both continents, and to possess unequaled facilities for procuring patents everywhere. In addition to our facilities for preparing drawings and specifications quickly, the applicant can rest assured that his case will be filed in the Patent Office without delay. Every application, in which the fees have been paid, is sent complete—including the model—to the Patent Office the same day the papers are signed at our office, or received by mail, so there is no delay in filing the case, a complaint we often hear from other sources. Another advantage to the inventor in securing his patent through the Scientific American Patent Agency, it insures a special notice of the invention in the SCIENTIFIC AMERICAN, which publication often opens negotiations for the sale of the patent or manufacture of the article. A synopsis of the patent laws in foreign countries may be found on another page, and persons contemplating the securing of patents abroad are invited to write to this office for prices, which have been reduced in accordance with the times, and our perfected facilities for conducting the business. address MUNN & CO., office SCIENTIFIC AMERICAN.

1857—1879.

OFFICE OF

R. J. Chard, Manufacturer of Oils, &c.,

134 MAIDEN LANE, NEW YORK.

Dear Sir:—The premises occupied by us for so many years having become too limited for our business, we have removed to No. 6 Burling Slip (within a block of the old stand), where we shall be pleased to meet our old customers. Thanking you for past favors, and trusting, with increased facilities, to merit a continuance of the same, we remain,

Your obedient servant,

R. J. CHARD.

Business and Personal.

The Charge for Insertion under this head is One Dollar a line for each insertion; about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

The best results are obtained by the Imp. Eureka Turbine Wheel and Barber's Pat. Pulverizing Mills. Send for descriptive pamphlets to Barber & Son, Allentown, Pa.

Valves and Hydrants, warranted to give perfect satisfaction. Chapman Valve Manuf. Co., Boston, Mass.

For Punches, Patent Bending-Rolls, Radial Drills, and Angle Iron Shears, Hilles & Jones, Wilmington, Del.

The Asbestos Roofing is the only reliable substitute for tin, it costs only one-half as much, is fully as durable, and can be easily applied by any one. H. W. Johns M'f'g. Company are the sole manufacturers.

Catechism of the Locomotive, 625 pages, 250 engravings. The most accurate, complete, and easily understood book on the Locomotive. Price $2.50. The Railroad Gazette, 73 Broadway, New York.

Magnets, Insulated Wire, etc., for experiments. Catalogue free. Goodnow & Wightman, 176 Washington St., Boston, Mass.

For Second-hand Engine Lathes, apply to Witherby, Rugg & Richardson, Worcester, Mass.

The Improved Hydraulic Jacks, Punches, and Tube Expanders. R. Dudgeon, 24 Columbia St., New York.

A. H. Downer's Improved Boiler Liquid removes scale without injury, thereby saving fuel and increasing power. 17 Peck Slip, New York.

Acme Lathes.—Swing, 7 in.; turn, 19 in. long; back geared; screw cutting. Send 3 cent stamp for circular and price, to W. Donaldson, southwest corner Smith and Augusta, Cincinnati, Ohio.

Shaw's Mercury Gauges, 5 to 50,000 lbs.; accurate, reliable, and durable. T. Shaw, 915 Ridge Ave., Phila., Pa.

The Twiss Automatic Engine; Also Vertical and Yacht Engines. N. W. Twiss, New Haven, Conn.

Wanted—An energetic party with capital, to publish and introduce a small book (copyrighted), which will sell in every town in the country. Address, with reference, J. W. S., Lock Box 1973, Phila., Pa., P. O.

New Pamphlet of "Burnham's Standard Turbine Wheel" sent free by N. F. Burnham, York, Pa.

17 and 20 in. Gibed Rest Screw Lathes. Geo. S. Lincoln & Co., Hartford, Conn.

Sheet Metal Presses, Ferracute Co., Bridgeton, N. J.

Diamond Engineer, J. Dickinson, 64 Nassau St., N.Y.

Eagle Anvils, 9 cents per pound. Fully warranted.

Clipper Injector. J. D. Lynde, Philadelphia, Pa.

A Cupola works best with forced blast from a Baker Blower. Wilbraham Bros., 2,318 Frankford Ave., Phila.

For Solid Wrought Iron Beams, etc., see advertisement. Address Union Iron Mills, Pittsburgh, Pa., for lithograph, etc.

Split Pulleys at low prices, and of same strength and appearance as Whole Pulleys. Yocom & Son's Shafting Works, Drinker St., Philadelphia, Pa.

The Ornamental Penman's, Engraver's, Sign Writer's, and Stonecutter's Pocketbook of Alphabets; 32 plates; 20 cts.; mail free. E. & F. N. Spon, 446 Broome St., N.Y.

Linen Hose.—Sizes: 1½ in., 20c.; 2 in., 25c; 2½ in., 29c. per foot, subject to large discount. For price lists of all sizes, also rubber lined linen hose, address Eureka Fire Hose Company, No. 13 Barclay St., New York.

Dead Stroke Power Hammers; cheapest and best for general forging and die work; 500 in use. P. S. Justice, of Philadelphia,

Forsaith & Co., Manchester, N. H., and 213 Centre St., New York. Specialties.—Bolt Forging Machines, Power Hammers, Combined Hand Fire Engines and Hose Carriages, new and 2d hand machinery. Send stamp for illustrated catalogues, stating just what you want.

Partner Wanted.—A party with limited capital.—Address Des Moines Linseed Oil Works, Des Moines, Iowa.

American Watch Tool Co., Waltham, Mass. Lathes for Optical Instrument Makers.

Presses, Dies, and Tools for working Sheet Metal. etc. Fruit & other can tools. Bliss & Williams, B'klyn, N. Y.

Nickel Plating.—A white deposit guaranteed by using our material. Condit, Hanson & Van Winkle, Newark, N.J.

Needle Pointed Iron, Brass, and Steel Wire for all purposes. W. Crabb, Newark, N. J.

The Lathes, Planers, Drills, and other Tools, new and second-hand, of the Wood & Light Machine Company, Worcester, are being sold out very low by the George Place Machinery Agency, 121 Chambers St., New York.

Twenty-five per cent saved by use of H. W. Johns' Asbestos Paints. 87 Maiden Lane, New York.

Hydraulic Presses and Jacks, new and second hand. Lathes and Machinery for Polishing and Buffing Metals. E. Lyon & Co., 470 Grand St., N. Y.

Solid Emery Vulcanite Wheels—The Solid Original Emery Wheel—other kinds imitations and inferior. Caution.—Our name is stamped in full on all our best Standard Belting, Packing, and Hose. Buy that only. The best is the cheapest. New York Belting and Packing Company, 37 and 38 Park Row, N. Y.

Portland Cement—Roman & Keene's, for walks, cisterns, foundations, stables, cellars, bridges, reservoirs, breweries, etc. Remit 25 cents postage stamps for Practical Treatise on Cements. S. L. Merchant & Co., 53 Broadway, New York.

For Sale.—7 foot bed Putnam Planer, $350. A. A. Pool & Co., Newark, N. J.

Manufacturers of Improved Goods who desire to build up a lucrative foreign trade, will do well to insert a well displayed advertisement in the SCIENTIFIC AMERICAN Export Edition. This paper has a very large foreign circulation.

C. M. Flint, Fitchburg, Mass., Mfr. of Saw Mills and Dogs, Shingle and Clapboard Machines. Circulars.

The best Friction Clutch Pulley and Friction Hoisting Machinery in the world, to be seen with power applied, 95 and 97 Liberty St., New York. D. Frisbie & Co., New Haven, Conn.

Wanted—A Machine for Cutting a Hide into a Continuous Strip preparatory to running it through the tubes for sewing machine belts. Address Edmund Hill, 531 Jefferson St., Philadelphia, Pa.

The 1879 Pennsylvania Lawn Mower.—Light draught and easily adjusted. Machines warranted. See illustrated editorial, Sci. Am., No. 14. Lloyd, Supplee & Walton, Philadelphia, Pa.

Renshaw's Ratchet (short spindle) uses taper and square shank drills. Pratt & Whitney Co., Hartford, Ct.

Wheels and Pinions, heavy and light, remarkably strong and durable. Especially suited for sugar mills and similar work. Pittsburgh Steel Casting Company, Pittsburgh, Pa.

Wood-working Machinery, Waymouth Lathes. Specialty, Wardwell Patent Saw Bench; it has no equal. Improved Patent Planers; Elevators; Dowel Machines. Rollstone Machine Company, Fitchburg, Mass.

The new "Otto" Silent Gas Engine is simple in construction, easy of management, and the cheapest motor known for intermittent work. Schleicher, Schumm & Co., Philadelphia, Pa.

Dead Pulleys that stop the running of loose pulleys and their belts, controlled from any point. Send for catalogue. Taper Sleeve Pulley Works, Erie, Pa.

Pulverizing Mills for all hard substances and grinding purposes. Walker Bros. & Co., 23d & Wood St., Phila., Pa.

The new fragrant Vanity Fair Cigarettes. New combinations of rare Old Perique and Virginia.

The SCIENTIFIC AMERICAN Export Edition is published monthly, about the 15th of each month. Every number comprises most of the plates of the four preceding weekly numbers of the SCIENTIFIC AMERICAN, with other appropriate contents, business announcements, etc. It forms a large and splendid periodical of nearly one hundred quarto pages, each number illustrated with about one hundred engravings. It is a complete record of American progress in the arts.

Notes & Queries

HINTS TO CORRESPONDENTS.

No attention will be paid to communications unless accompanied with the full name and address of the writer.

Names and addresses of correspondents will not be given to inquirers.

We renew our request that correspondents, in referring to former answers or articles, will be kind enough to name the date of the paper and the page, or the number of the question.

Correspondents whose inquiries do not appear after a reasonable time should repeat them.

Persons desiring special information which is purely of a personal character, and not of general interest, should remit from $1 to $5, according to the subject, as we cannot be expected to spend time and labor to obtain such information without remuneration.

Any numbers of the SCIENTIFIC AMERICAN SUPPLEMENT referred to in these columns may be had at this office. Price 10 cents each.

(1) G. E. M. asks: Can you tell me how the fine lines of a micrometer, used in measuring microscopical objects, are ruled? A. By means of a very accurate and expensive machine called a dividing engine.

(2) P. J. W. asks: 1. What size battery will produce an electro-magnet of 50 lbs. lifting power? A. Use four or six cells of Bunsen. 2. Is there any means of estimating the attractive power of an electro-magnet at any given distance from its poles, the power at the pole being known? A. Magnetic attractions and repulsions are inversely as the squares of the distances.

(3) W. A. B. asks: 1. How can I procure the powered silver you mention in your issue of March 22, used in the Righi telephone? Will very fine silver filings do? A. We do not know that it is in the market; you can make it by grinding silver leaf with honey on a marble slab, afterward carefully removing the honey by repeated washings. 2. Are the wires connected the same in this telephone as in the carbon telephone? A. One wire is connected with the spring; the other to the metal plunger attached to the diaphragm.

(4) L. O. B. asks: 1. Does it make any difference which binding post of a Bell telephone is connected to the zinc pole of a battery? If it does how must it be connected? I want to experiment with a microphone. A. No. 2. Will one cell of a Watson battery be sufficient to operate a call bell, on a line 1 mile long? A. No; use four.

(5) G. R. D. asks: 1. What kind of paper is used to produce the stencil with the mechanical pen? A. Any thin paper, of smooth, firm texture. 2. How are copies taken after the stencil is made? A. By stretching the stencil in a frame, placing it in contact with the paper to receive the copy, and passing over it a roller charged with stencil ink.

(6) A. B. & B. ask: 1. How big a wire rope will it require, stretched over a span of forty feet, to sustain a load of one ton or 2,000 lbs.? A. .75 to .8 inch diameter. 2. How much will such a rope deflect in center, when stretched moderately tight, and what means are employed to get such a rope stretched tight enough? A. 3½ feet. Consult Stahl's "Power by Wire Ropes."

(7) A. B. P. asks: 1. In making small magnets must I use fine or coarse wire? Tell why telegraph sounders are made with very fine wire, and magnets made to break the currents in shocking machines are coarse. A. The size of wire required for a magnet will depend altogether on the purpose for which the magnet is intended. The resistance of the wire is proportional to its size. If the magnet is used on a line of small resistance, the wire may be larger than when the resistance is great. Consult a good work on electricity. 2. How to make carbon for batteries. A. See SCIENTIFIC AMERICAN SUPPLEMENTS, Nos. 157, 158, and 159.

(8) P. J. asks: 1. In constructing an induction coil would hard wood or bone answer instead of vulcanite for the cylinder for commutator? Also for the tray in the "Simple Electric Light," described in SUPPLEMENT No. 162? A. Yes, in either case; but it should be filled with paraffine. 2. Will silver answer in place of platinum for point of screw and contact piece on the spring of the vibrating armature? If not, why? A. No; it will burn out too easily. 3. What is "tea paper," and where can I get it? A. The thin white paper used by grocers.

(9) S. W. writes: I am trying to plate steel knives and forks with tin. Please tell me what will cause the tin to flow smooth and appear white when finished. A. Clean the metal by scouring with moist pumice stone powder, and rinse in clean hot water, which will cause it to dry quickly. Then dip it in the melted tin covered with rosin, removing it frequently to rub with a brush of clean hemp. Then transfer for a short time to a pot of very hot tallow, free from salt, on removal from which tap smartly to remove list; cool, and clean with sawdust.

(10) D. B. B.—Please give a recipe for acid bath and process for resharpening old files in such a bath. A. The files must be thoroughly cleansed in warm water containing a small quantity of potash, which readily removes all the grease and dirt. After they are thus cleansed they must be washed with warm water and dried by artificial heat. Next place 1 pint of warm water in a wooden vessel and put in as many files as the water will cover, then add 2 oz. blue vitriol (sulphate of copper), finely pulverized, and 2 oz. borax, well mixed, taking care to turn the files over so that each may come in contact with the mixture. To the above mixture now add 7 oz. sulphuric acid and ¼ oz. cider vinegar, which will cause the files to assume a red appearance at first, but they will in a short time resume their natural color. Then remove them, wash in cold water, and dry by artificial heat. When dry, sponge with olive oil, wrap in porous paper, and lay aside for use.

MINERALS, ETC.—Specimens have been received from the following correspondents, and examined, with the results stated:

C. M. M.—It is chiefly composed of iron pyrites (fool's gold)—of no value.—S. P.—The bead contains iron and copper—no silver.—H. B. It is an impure potter's clay. Properly washed it might be worth about a dollar per ton at the pottery.—E. F. A.—It is clay slate. It does not contain an appreciable quantity of gold or silver.—W. R. C.—It is a brown hematite (iron ore) of some value.

COMMUNICATIONS RECEIVED.

On Pigeon House. By H. R.
On Squaring the Circle. By R. R. P.
On Squaring the Circle. By C. M. G.
On Ice Caves. By A. L. R.
On Life and Electricity. By T. B. M.
On Grain Binding Material. By N. C. T.
On Sewer Gas. By D. W.

[OFFICIAL.]

INDEX OF INVENTIONS

FOR WHICH

Letters Patent of the United States were Granted in the Week Ending

April 1, 1879,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

A complete copy of any patent in the annexed list, including both the specifications and drawings, will be furnished from this office for one dollar. In ordering, please state the number and date of the patent desired and remit to Munn & Co., 37 Park Row, New York city.

Adjustable bracket, Redman & Conklin	213,775
Advertiser, street lamp, S. Smith	213,785
Albumen for the production of moulded articles, treatment of, J. Bliss	213,733
Annunciator, bell, C. Pilout	213,834
Axle box, car, J. R. Baker	213,731
Axle box, car, F. W. Schroeder	213,842
Band cutter, W. J. Kellar	213,758
Basin, catch, J. B. H. Nolte	213,832
Bed bottom, spring, H. Baer	213,803
Boot and shoe screw wire, E. F. Richardson	213,938
Bow, N. R. Streeter	213,851
Box pile, E. Wheeler	213,855
Brick kilns, fireproof arch for, J. R. Bowers	213,805
Brush block borer, C. A. Mahle (r)	8,647
Buckle, C. Hersome (r)	8,655
Building, fireproof, J. J. Schillinger	213,945
Burglar alarm, J. A. Reese	213,936
Burial case, Leach & Hiser	213,762
Car brake, railway, G. Marshall	213,915
Car coupling, W. J. Orr	213,928
Car coupling, Shafer & Ewart	213,946
Car drawbar, railway, J. H. Coxey	213,810
Car starter, A Christin	213,872
Car starter, S. Graham	213,895
Car starter, W. A. Warriner	213,959
Car, street, W. P. Hansell	213,899
Carbureter, air and gas, E. A. C. Pew	213,931
Card clothing, H. E. Cunningham	213,876
Carriage door sash frame, W. Ruby	213,778
Carriage top, F. A. Presko	213,933
Cartridge, J. E. Tyler	213,958
Cartridge loader, C. A. R. Dimon	213,877
Caster, sewing machine, J. O. Sloan	213,844
Chain, log or bull, R. J. Millen	213,769
Cheese vats, milk agitator for, M. P. Jackson	213,755
Chests, construction of, G. V. Luce	213,913
Cigar stand, J Grzybowski	213,747
Cistern, drain, T. Houston	213,886
Clock pendulum clutch, E. Davies	213,811
Clothes line support, W. W Gledhill	213,746
Clothes pounder, C. F. K. Wilson	213,962
Cock, water and steam, W. H. Hoyt	213,903
Coin counter, H. Clark	213,738
Coin wrapper, G. Rettig (r)	8,649
Column, F. H. Smith	213,786
Cooker and steamer, T. Lee	213,763
Corn dropper and marker, J. A. & J J Stephenson	213,788
Crane, mail bag, H. M. Hall	213,750
Cultivator fender, A. & M. Simmons	213,948
Cultivator, wheel, A. Sanders	213,943
Curtain fixture, G. C. Mathers	213,917
Dam, D Tufts	213,957
Dental engine, H. Laurence	213,809
Dental plate, W. D. Holbrook	213,820
Desk and work table, writing, E. Emanuel	213,814
Direct acting engine, W. F Garrison	213,890
Discharge pipe plug, wash basin, etc., J. S. Gilbert	213,891
Dish heater and holder, S. R. Jarvis	213,904
Ditching machine, Grant & McClelland	213,897
Dyeing aniline black, H. Kinsbourg	213,907
Egg carrier, J. L Stevens	213,848, 213,849, 213,850
Egg lifter, B. W Nelson	213,772
Feed water heater, Goodwin & Joyce	213,892
Fence, J. R Elliott	213,882
Fence, A. G. Powell	213,932
Fence, D. Wright	213,799
Fence, iron, I. L. Sherman	213,947
Fiber, animal, J. A. Southmayd	213,949
Fiber separator, J. A. Southmayd	213,950
File, letter, J. F. Tapley	213,852
Filter, J. Grant	213,896
Firearm, breech-loading, C. A. King	213,760
Firearm, magazine, A. Burgess	213,866 to 213,869
Fire kindler, J. McShane	213,768
Fireproof box for papers, etc., N. Fowler (r)	8,654
Forging hammers, D. Maydole	213,766
Fur articles, S. D. Castle	213,736
Furs, treating, S. D. Castle	213,735
Furnace, E. W. & C. W. Blair	213,861
Gas burner, M. B. & C. G. Dyott	213,879
Gas lighter, electric, W. H. H. Whiting	213,795
Gas meter, wet, G. Lizars	213,911
Gas regulator, S. F. Leach	213,910
Glass furnace, D. Agnew	213,858
Gold beater, J. H. Cooper	213,874
Grain, apparatus for removing germs and fuzz from, Potts & Parson	213,774
Grain binder, F. W. Randall	213,838
Grain separator, W. S. Reeder	213,934
Grain separators, straw carrier for, W. S. Reeder	213,935
Grate bar, J. Ashcroft	213,730
Grave or tomb, J. H. Thorp	213,790
Grinding mill, middlings, J. Mills	213,922
Guano and seed distributer, J. Scoggin	213,843
Gun, magazine, A. Burgess	213,865
Harness, gag runner for, W. M. Blain	213,862
Harvester grinder, R. P. Clarke	213,873
Hat, wire brim, L. T. Smith	213,846
Hay rake, horse, A. W. Mathis	213,839
Heating pot, H. J. Nelson	213,926
Heel shave, H. A. Lothrop	213,827
Heel trimmer, J H. Busell	213,806
Horse blinder, I. R. Armstrong	213,800
Horse power, P. K. Dederick	213,742
Horseshoe weight, J. Robinson	213,939
Hot air engine, H. W. Sherrill	213,783
Hot air furnace, W. J Towne	213,791
Hydraulic engine, L. K. Fuller	213,745
Hydraulic engine, J. Talley, Jr	213,952
Infusions, making, R. U. Etzensberger	213,815
Inlaying metallic scroll ornaments in hard rubber and allied gums, M. Smith	213,784
Joint for solid and tubular connections, C. H. Jackson	213,754
Knit vest or jacket for female wear, J Cave	213,808
Knitting machine, E. Tiffany	213,956
Ladders, portable platform for fire and other, M. Cronin	213,741
Lamp, C. F Spencer	213,951
Lantern, railway signal, D. W. F. De Grange	213,812
Lasting machine, device for applying power from a rotating shaft to a, Woodward & Brock	213,857
Latch, closet, W. E Sparks (r)	8,644, 8,645
Levees, protecting, J. Johnson	213,822
Liniment, S. C Buchanan	213,863
Log roller, E. Tarrant	213,953
Loom temple, Porter & Clark (r)	8,656
Lounge, folding, O. Stechhan	213,847
Machinery motor, J. Williams *et al.*	213,797
Meat, preserving raw, A. A. Libby	213,824, 213,825, 213,826
Mechanical motor, A. G. Kiler	213,759
Metals, working cast malleable, E. Wheeler	213,856
Millstone pick, R J. Wheatly	213,961
Millstones, ventilating, G. Helfert	213,900
Naphtha burner, U. P. Smith	213,845
Nozzle, noise-quieting steam, T. Shaw (r)	8,643
Odor destroyer, B. J Tayman	213,853
Ore separating jigger, W. H. Plumb (r)	8,653
Ores in their natural situation, process and apparatus for melting, C. M. T. Du Motay	213,789
Ore reducer, J Seanor	213,782
Packing, piston, E. B. Colby	213,739
Packing spring, piston, J. Sadler	213,942
Padlock, W. C McGill	213,918
Padlock, Wirth & Wichert	213,798
Paper bags, making, Nugent & Burns	213,773
Paper perforator, W Koch	213,908
Pedal mechanism, W. R. McDonald	213,767
Peg rasper, W. B. Arnold	213,729
Pelts, finishing, S. D. Castle	213,737
Pencil, L. De Faber	213,884
Pianoforte action, G. O. V. Roedern	213,940
Pitman connection, A D. Love	213,912
Planters, check rower for corn, L. B. Berrien	213,732
Plow, C. V. Dyer	213,878
Plow, gang, L. M Kelly	213,906
Printing press perforator, J. A. Carruth (r)	8,646
Printing press sheet deliverer, S. D. Tucker	213,793
Pump, double-acting, W. Rodda	213,776
Pump, force, W. H. Kacy	213,757
Pump, hydraulic, W. Foster	213,817

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Punching machines, feeder for, T. R. Morgan. . 213,770
Railway bearing cushion, lamin., F. W. Schroeder 213,841
Railway, elevated, J Johnson 213,905
Railway track, portable, J. Morgan, Jr..... 213,923
Range, cooking, J. Jewett..... 213,756
Ratchet wrench, S. W. Martin..... 213,916
Reamer, H Reichardt. 213,937
Reclining chair, J. E. Graetz 213,894
Reflector, W J Flick 213,744
Refrigerating apparatus, B. F. Teal 213,954
Refrigeration or freezing of liquids, apparatus for the, H. J West..... 213,794
Refrigerator, A. H. Heinz. 213,751
Rein holder, C. M. & E. R. Parker 213,930
Roof, wooden, A J. Conner..... 213,740
Saddle, cart, E A. Franks 213,887
Saddle pads, fastener for harness, T. Buswell 213,870
Sandpapering machine, W Carlisle 213,807
Sash lock, H. A. Holt 213,821
Saw filing machine, T. L. Nanney..... 213,925
Saw frame, Gage & Linscott..... 213,889
Saw handle, crosscut, M E. True 213,792
Scales, platform, Fairbanks & Spencer..... 213,743
Scales, weighing, D. Hallock..... 213,898
Scow dumping, M. P. Walsh..... 213,854
Screw press, P R. Campbell 213,871
Sewer gas from basin overflows, device for preventing the escape of E. Blunt..... 213,862
Sewing machine needle bar, N. Hayden 213,819
Sheet metal coupling fastener, C F Henis..... 213 901
Shipping case, W B & H C Atkinson..... 213 859
Shoe holder, B Elliott 213,881
Shovel and spade metallic socket, H.A.Thompson 213,955
Soldering iron, J J Henry 213,902
Spool or bobbin, metallic, G. A. Lambert. 213 761
Spoon, sheet metal, J Fallows (r)..... 8,650
Steam boiler, upright, P Quinn 213,837
Steam pipes, etc., mould for the manufacture of heat-retaining coverings for, C. A. Evans..... 213 883
Stench trap connection R. McBee..... 213 831
Stocking knee protector W A. Lighthall 213 764
Stone moulder and surfacer J W. Maloy 213,828
Stone, etc polisher J W Maloy..... 213 829
Stove hearth S. R Burton *et al*..... 213,864
Stud or button shirt D S Spaulding. 213 787
Stuffing box. H S Ross 213,777
Sugar mould, E Langen (r) 8,642
Swing S Mackbee 213 914
Tablet, manifold writing, Morris & McLane..... 213,771
Tap, barrel, E. J. Rubottom 213,839
Telegraph, automatic, A G. Ryder 213,779
Telephone, acoustic, J Draper 213,813
Telephone signaler, Paris & Lange 213,929
Thill coupling, C. A. Williams 213,796
Thrashing machine straw carrier, F Kitten (r) ... 8,652
Time lock, C. E Chinnock 213,809
Tire tightener washer, D. R. Lucas..... 213,765
Toy hand car, F. R. Hadley..... 213 749
Truck, car, F. W Schroeder 213,840
Trunk catch C. H Nye 213,927
Valve gear, steam pump L J Knowles 213,823
Vapor or gas engine, F. A. T De Beauregard..... 213,860
Vegetable parer, H. Ehmann 213,880
Vehicle spring, O S. Gorton 213,893
Vehicle spring, A. Gummer..... 213,748
Vehicle spring, W. S Haggard 213,818
Vehicle spring brace, J. P. Fuller 213,888
Violin chin rest, H. C. Barnes..... 213,804
Vise, G B Foote 213,816
Voting register, electric, R O Crowley 213,875
Wagon body corner iron, J. L. Morgan..... 213,924
Wagon, road, C. W. Saladee 213,780
Washing machine, C P Rood 213,941
Watch key, adjustable, W Haines (r)..... 8 648
Watch, stem winding and setting, U Oppliger . . 213,833
Water closet, F Pohley..... 213 835
Water closet cistern, automatic, S. McKissock... 213,920
Water cooler, Quigley & Grayson..... 213,836
Water meter, oscillating, S T Sanford..... 213,944
Water motor, W R. Fox 213 885
Water wheel, turbine, J McLucas 213,921
Wells, rod coupling for oil, Z. McGinnis 213,919
Wind wheel, G Schweizer..... 213,781
Windmill, T. Bickerman 213,801
Windmill, Warwick & Marshall 213,960
Wire rope, sheave for, C W. Hunt 213,753
Wooden box trimmer, J. Bozorth 213,734

TRADE MARKS.

Cotton piece goods, Stark Mills..... 7,142
Cough and croup sirup, C. B Kingsley 7,140
Gin, F. Boegler 7,146
Ginger ale, Cantrell & Cochrane..... 7,148
Gloves, Goodyear's India Rubber Glove Manufacturing Company 7,149
Hair tonic restorative, and dressing Ziegler & Case 7,145
Leather Kiefer, Stifel & Co..... 7,143
Metal polish H. Behr & Co..... 7,139
Neat's foot oil, H J. Linneman 7,150
Needles, Liebenroth Von Auw & Co..... 7,141
Plows, Carr & Hobson 7 147
Salves and pills, Jahne & Co 7,145
Silk ribbon, J. Silbermann 7,151
Soap, F. S. & T M Lincoln 7,154
Standard weights and measures, College of Pharmacy of the City of New York 7,144
Tonic cordial, J Tardos..... 7,152
Whisky, Lathrop & Leigh 7,153

DESIGNS.

Buttons, T. F. N. Finch..... 11,137
Carpet, C. Magee 11,130
Carpet, D. McNair..... 11,136
Corset, M. P Bray..... 11,127
Font of printing types, J M. Conner 11,128
Handkerchief, J. Nightingale 11,134
Oil cloth, T. E. Pennell 11,135
Oil cloth, J. Hutchison 11,129
Oil cloth, C. T. & V. E. Meyer.....11,131 to 11,133

English Patents Issued to Americans.

From April 1 to April 8, inclusive

Animal fibers, material from, J A. Southmayd, U. S.
Berths, G. Sickels, Boston, Mass.
Boxes for transmitting samples, F. F. Atkinson, New York city
Cooking food, J W. Jones, Portland, Me.
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GENERAL TABLE OF CONTENTS

Of the SCIENTIFIC AMERICAN Export Edition for April, 1879.

I.—INVENTIONS, DISCOVERIES, AND PATENTS.
Barnum calls for a New Invention.
Supreme Court Decision.
Miscellaneous Inventions.
Improved Lawn Mower. One engraving.
Recent American Patents.
Some Recent American Patents. Fourteen engravings.
Phonograph.
An Improved Press. Two engravings.
Fillings for Safes.
New Automatic Siphon. One figure.
New Shipping Tag. One engraving.
Herreshoff Torpedo Launch. Three engravings.
Improved Washing Machine. Two engravings.
Novel Bird Box. One engraving.
New Attachment for Boilers. One engraving.
Applications of Celluloid.
Self-Luminous Clock Dials.
Machine for Stretching and Softening Textile Fabrics. One engraving.
New Fender for Vessels. One engraving.
Important Patent Flour Case.
American Mechanical Inventions.
Agricultural Inventions.
Recent Mechanical Inventions.
Defect of the Patent Bill.
Johnson's Watering Trough for Cattle. One engraving.
New Alleged Preserving Agent.
Loading Apparatus for Ordnance. One engraving.
Novel Baggage Fastener and Shawl Carrier. One engraving.
Brick Making by Machinery. One engraving.
New Dough Kneader. One engraving.
New Great Gun.
Edison's Induction Balance. Five figures.
Prof. Hughes' Induction Balance. Two engravings, seven figures.
A New Pedometer. Two engravings.
Dean Brothers' Steam Pump. One engraving.
Improvement in Sugar Making.
A Convenient Box for Artists. One engraving.
Improved Barrel for Breech Loading Shot Guns. Three engravings.
A New Carbureter. One engraving.
Novel Rotary Engine. One engraving.
Engineering Inventions.
A Telephone 28 Years Ago One engraving.
Edison's Electro-Chemical Telephone. Two engravings, two figures.
New Explosive.
The Fast Ice Boat.
Steamboat smaller than "Nina."

II.—MECHANICS AND ENGINEERING.
Speed of Belting.
Security of East River Bridge.
Niagara Bridge.
Small Stationary Engine.
Prices for Yacht Engines.
Miss Hosmer's Motor.
Locomotive Air Pumps.
Amateur Mechanics (Chasing and Knurling). Twenty-eight engravings.
Emery Belts and Wheels.
Heslop Steam Engine.
Engines of the Yacht Isa. Two engravings.
Blasting by Compressed Air.

III—MINING AND METALLURGY.
Ohio Coal Field.
Western Iowa Coal Fields.
Refined Copper.
Mining District of Leadville.
Ornamenting Steel Surfaces.
Valuable Mineral Collection, etc.
Silver Reduction in Colorado.
The Utilization of Sulphides as Fuel in Metallurgy.
A Collection of Meteoric Specimens.
Nevada Paint Mine.

IV —CHEMISTRY AND PHYSICS.
A New Acoustic Apparatus. Two engravings.
Astronomical Notes. Giving the Positions, Rising, and Setting of the Planets for April.
Dynamo-Electric Machine
Ice Explosion.
Heinrich Geissler.
Gary's Alleged Neutral Line.
Note from Mr. Gary in regard to Neutral Line.
Parabola. One figure.
Magnetized Steel.
Telephones.
Vibrations of the Plate of a Bell Telephone.
Statical Electricity.
Legal Standard of Kerosene.
Home of the Meteors.
Morning Mirage.
Paintings Reproduced by Photography.
Photographs at Midnight.
Photography by Electric Light.
Photography in Banking.
Polariscope for Testing Sugar.
A Singular Storm.
Gary's Nail Experiment. Three figures.
Gary's Neutral Line.
Heinrich Wilhelm Dove.
Spontaneous Combustion.
Spectrum of Brorsen's Comet.

V.—NATURAL HISTORY, NATURE, MAN, ETC.
The Bobac. One engraving.
Domestication of the Buffalo.
Mute Cattle.
Chloride of Lime as an Insecticide.
Wisconsin Cranberry Marsh.
The Lawn.
Working Monkeys.
Poison of Serpents
Aleutian Islands Shell Heaps.
The Ailanthus as Timber.
Alligators taught by Experience.
Useful Bacteria.
Forceps Crab. One engraving.
A plea for the Crow.
A Fern Valley.
Origin of Existing Floras.
Hotbeds.
A Canine Mind Reader.
Argan Tree.
Snapping Giant Turtle.
Cape Buffalo. One engraving.
A Shower of Pollen.
Texas Cattle Drive for 1879.
Australian Insects in California.
Coniferine and Vanilline.
Capture of a Devil Fish.
Fennec or Sahara Fox. One engraving.
Flying Frog. One engraving
Natural History Notes.
One that would not Starve (Snail).
Utility of Toads.
Trimming Tigers' Toes.
Borers in Apple Trees.
What became of One Hive of Bees.
Trade in Birds.
Fate of a Herd of Buffalo.
Cabbage Worm.
The Great Crab Spider. One engraving.
Diphtheria in Fowls.
Sod Fences.
Flowers in Winter.
The Peanut Crop.
Snakes as Pets.
Swine in the United States.

VI.—MEDICINE AND HYGIENE.
Dangers of Lead Poisoning from the Use of Tinned Ware.
Effect of Vitriol on the Skin.
Why so Depressing?
Tape Worm in Cucumbers.
Grafting Eyes upon the Blind.
Jaded Heads.
Condition of Idiocy.
Anointing in Infantile Disorders.
Effect of Boiling on Milk.
Scarlet Fever.
Preventing Seasickness
Gases of the Stomach.
Beer Drinking in the United States.
Toxicological Notes.
Remedies for Biliousness.
Curiosities of Bismarck's Brains.
Frost and the Yellow Fever.
Neglect of Rest.

VII.—SCIENTIFIC MEETINGS, EXHIBITIONS, ETC.
New York Academy of Sciences.
Free Institute of Science.
Industrial Cincinnati Exposition.
World's Fair of 1883 at New York.
Site of the United States Exhibition.
Reports on the Paris Exhibition.
The Australian Exhibitions.

VIII.—INDUSTRY AND COMMERCE.
The Netherlands open to American Tools.
American and English Artisans.
Labor and the Cost of Living.
Canning Meat by Machinery.
Victory for Millers.
Colored Pencils for Glass.
Refined Petroleum.
Dangers to Railroad Brakemen.
Large Ocean Steamship.
National Surveys.
Canadian Canal Project.
Faience and its Manufacture. No.1 Two engravings.
Reproduction of Ancient Glass.
Ground Honey.
Immigration in 1878
Seaboard Pipe Line.
Collecting Postage Stamps.
Woman the Primitive Pottery Maker and Decorator.
Calamity at Szegedin.
Fine Cast Iron Table. One engraving.
Oldest and Coldest Town.
Wire in Wheat.
Wood Pavements in London
Architects, Trials and Tribulations.
Art as an aid to Industry.
Japanese Bronzes.
The Suez Canal.
The Coliseum Drained.
Good Times for American Farmers.
A Warning to Western Farmers.
American Iron for China.
Isinglass from Sea Weeds.
Pinto's Journey across Africa.
Baltimore Water Works.
Coal at its Lowest.
Long Lived Brewery.
Engraved Silver Water Bottle. One engraving.
Around the World in Thirty Days.
Balloon Expedition to the Moon.
Profits on Beer and Milk.
The Bicycle as a Road Vehicle.
African Cable.
American *vs.* English Castings.
Aniline Colors.
Faience and its Manufacture. No.2. Seven engravings.
Possible Cause of Fires.
American Flour in Turkey.
Old Homes Made New. Three engravings
Iron in New Zealand.
Leadville, the Place.
Mildew in Cotton Goods.
American Petroleum in Europe.
German Gray Pottery. One engraving.
A Thriving State.
Textile Industries of Finland.
Unconsidered Uses of Wood.
The Sizes of Ferments.

IX.—PRACTICAL RECIPES AND MISCELLANEOUS.
Rare Old Books at Auction.
Cement to Stick Rubber to Iron.
Browning Gun Barrels.
Aniline Black Ink.
To Clean Lace.
Notes and Queries.
Advantages of Silence.
To Polish Tortoise Shell.
Alcoholic Shellac Varnish.
Cheap Black Varnish.
Back Numbers.
Executive Ability.
Have we too Many Colleges?
Common Sense.
SCIENTIFIC AMERICAN Better than Dime Novels.
Waterproofing Cotton and Linen Fabrics
Cement for Metal and Glass.
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Important Appointments.
The Moon, Is it Inhabited?
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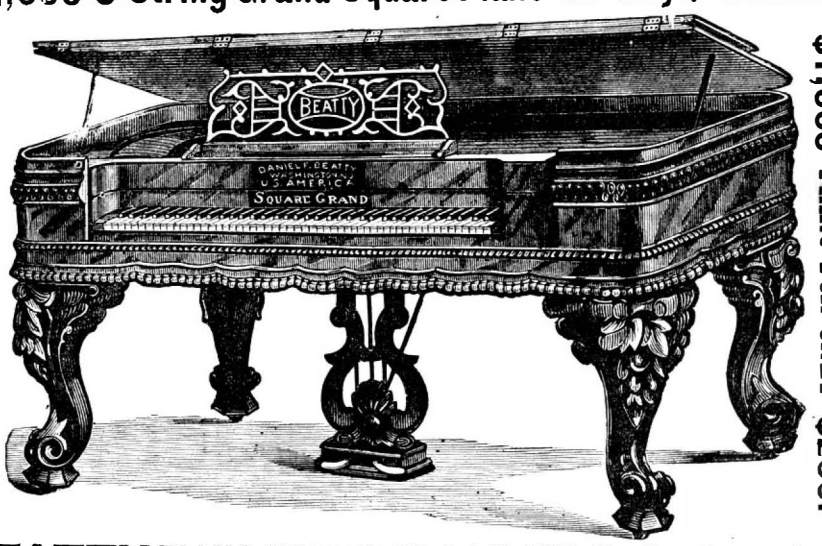

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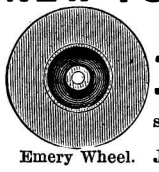
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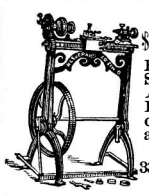

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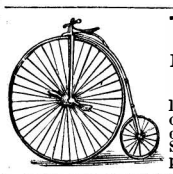

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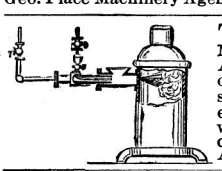

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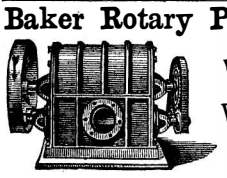

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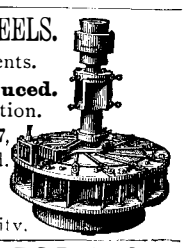

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(Signed,)

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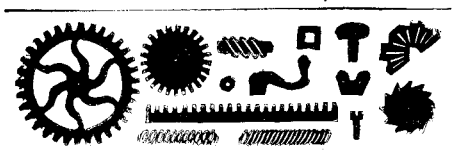

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OFFICE OF THE
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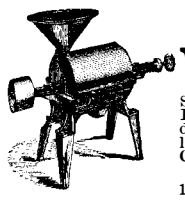

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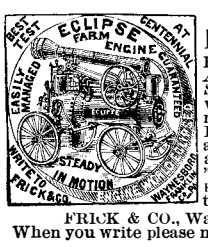

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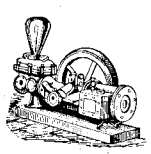

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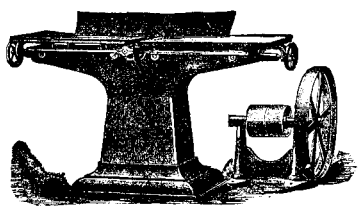

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